Which Banks Smooth and at What Price?*

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August 25, 2019

Abstract

By adjusting lending, banks can smooth the macroeconomic impact of deposit fluctuations. This may, however, lead to extended periods of disproportionately high lending relative to deposit intake and, under certain conditions, to the accumulation of risk in the banking system. Using bank-level data for 8,477 banks in 129 countries for the period from 1992 to 2015, we examine how banks' market power and other characteristics may contribute to smoothing or amplification of shocks and the accumulation of risk. We find that the higher their market power the lower is the growth rate of lending relative to deposits. As a result, in periods of falling deposits higher market power for the average bank is associated with a greater fall in lending, consistent with amplification of adverse effects during relatively bad times. Strikingly, at very high levels of market power, there is a threshold past which the effect of market power on the growth rate of lending relative to deposits turns positive so that "superpower" banks may contribute to the smoothing of adverse effects when deposits are falling. In periods of rising deposits, however, such banks are more likely to lead to amplification and accumulation of risk in the economy.

Keywords: smoothing, amplification, risk accumulation, market power, activity restrictions, competition, crisis.

JEL Classification: E44, F3, G21.

*We thank Manthos Delis, Vasso Ioannidou, Alex Michaelides, Andy Mullineux, Fotios Pasiouras, John Wilson and conference participants at IAAE 2019, Royal Economic Society 2018, 2^{nd} Contemporary Issues in Banking, iCare and ICMAIF 2018

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1 Introduction

By adjusting their lending, banks may smooth or amplify the impact of deposit fluctuations on corporate and individual borrowers and the macroeconomy as a whole. This, however, could lead to extended periods of disproportionately high lending relative to deposit intake and, under certain conditions, to the accumulation of risk in the banking system. Indeed, previous work and recent experience have shown that banks can amplify shocks or even create preconditions for financial instability by accumulating risks; excessive and sustained credit expansions build up risk in the economy over time and can give rise to financial crises.[1] As a regulatory response, Basel III, for example, includes provisions to limit unsustainable excessive lending such as a mandatory, as of 2018, Net Stable Funding Ratio (NSFR) requirement.

Existing research points at market power as a prominent factor that governs banks' decisions and lending in particular. However, the degree to which it affects smoothing and/or risk accumulation is unclear, with theory and empirics producing mixed results. Competition has been shown to both increase banking risks (Keeley, 1990), and to reduce them (Boyd and De Nicolo, 2005). Allen and Gale (1997) theorize the importance of market power for smoothing: competitive banks are deemed to fail to smooth shocks. Much of the earlier literature focused on the willingness of banks to lend, while more recent research, such as Ovtchinnikov (2010) for corporations in general, and Berger et al. (2019) for banks in particular, demonstrates competition may also affect their ability to fund lending. As smoothing and amplification are linked to both risk-taking and fund-raising, a joint investigation is required. To this end, we ask to which extent can the degree of banking competition determine smoothing-ability and how does this

[1] Jordà et al. (2013) show that credit expansions have been a driver of the depth of subsequent recessions in advanced economies. Using the same 140-years long database from 1870 to 2008 for 14 advanced economies, Jordà et al. (2011) showed that credit growth has been the single best predictor of financial instability.

relate to the accumulation of risk in the macroeconomy.

More specifically, focusing on banks' market power we ask which banks are less likely to amplify shocks or accumulate risk via their prudence in lending during periods of rising deposits, and which banks are more likely to smooth the impact of falling deposits. It turns out that smoothing during booms, when deposits grow, comes at the cost of amplification of adverse effects during periods of falling deposits, while the ability to maintain lending during economic downturns is associated with amplification of positive shocks and risk accumulation during periods of rising deposits.

The questions we ask here are arguably intriguing, not only because of the potentially destructive consequences of risk accumulation within the banking system but also because of the potential importance of banks' smoothing ability for macroeconomic outcomes.[2] Smoothing by banks would enable inter-temporally optimizing agents to bring consumption and investment forward, reflected in flatter consumption profiles directly increasing current welfare, as well as in the growth-enhancing avoidance of temporary declines in investment during relative bad times associated with falling deposits.

To answer the above questions, we will be using bank-level data for 8,477 banks in 129 countries over the period 1992-2015. The large variation in our data allows us to consider a vast array of economic conditions faced by individual banks across different countries over time. In particular, variation across the degree of competition faced by individual banks in different environments over time enables us to investigate banks' smoothing ability and risk accumulation during periods of falling or rising deposits in relation to the degree of competition they face. We estimate the Lerner index as a measure of the degree of market power at the bank-year level using a semi-parametric functional form.[3] We obtain exogenous variation in market power using activity restrictions at the

[2]In Choudhary and Limodio (2017), e.g., an increase in deposit volatility translates into shortening of loan maturities and through that lowers aggregate output.

[3]This takes into account the heterogeneity in the production technology across banks, countries, and

country-year level as in Barth et al. (2013).

To measure smoothing and amplification, we introduce the lending-funding growth gap, which is the difference between annual growth rates of loans and deposits. Conveniently, this measure also relates to the "customer funding gap" used in the literature to characterize banks' liquidity risk and to the Net Stable Funding Ratio (NSFR) used as a regulatory requirement to constrain the build-up of risk.[4] As the impact of market power on smoothing, amplification and risk accumulation has not previously been jointly investigated, this constitutes the main focal point of our analysis.

A number of theoretical reasons suggest an inverse relationship between the degree of competition and banks' smoothing ability.[5] In Allen and Gale (1997), competition wipes out the ability of banks to create sufficient reserves to smooth fluctuations, while in Gersbach and Wenzelburger (2001, 2011) it limits profit-making and thus the ability to cover current period losses, which are then transferred to future periods. The ability of banks to smooth rates on loans offered to borrowers in Berlin and Mester (1999) crucially depends on the ability to derive monopolistic rents in the deposit market. In Boot and Thakor (2000), although competition between banks leads to more relationship lending, it brings fewer benefits for borrowers; moreover, if banks compete with financial markets, relationship lending shrinks. Sette and Gobbi (2015) review previous results for the impact of competition on relationship lending which imply that higher competition (lower concentration) dampens the smoothing effect of relationship lending.

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time, and is estimated for 11,957 banks in 131 countries for 1988-2015.

[4]See, e.g., Albertazzi et al. (2014) for the characterization of banks' liquidity risk through the customer funding gap, and BoE (2009, 2011) for the usage of it as an indicator of risks to financial stability.

[5]There are two main foci in the literature: (1) relationship lending (Petersen and Rajan, 1995; Berlin and Mester, 1999; Boot and Thakor, 2000; Bolton et al., 2013; Sette and Gobbi, 2015; Beck et al., 2014) and (2) intergenerational transfers (Allen and Gale, 1997; Gersbach and Wenzelburger, 2001, 2011; Vinogradov, 2011). The first one is on the selection of borrowers where if the bank has to cut down lending, established long-term clients suffer last. The second one is on the facilities enabling smoothing by banks. These are either accumulated reserves or transfers of current period "deficits" into future periods where current period losses are covered by short-term borrowing.

To sum up: in the existing literature, banks' mechanism to smooth lending consists of two main elements: (1) availability of funds, either through accumulated reserves or via borrowing from alternative sources, and (2) incentives to allocate these funds to existing borrowers. Relationship lending contributes to the latter incentives, yet it is just one of a number of possible channels. Although the empirical literature suggests market power can affect relationship lending, no evidence exists for the role market structure plays for the smoothing mechanism as a whole, which is what we explore here.

Estimating the impact of market power on the lending-funding growth gap, however, is subject to endogeneity concerns. In this regard, we first note that the Lerner index we use to measure market power contains lagged prices which are less likely to be affected by future realizations of the difference in the growth rates of loans and deposits. To further alleviate concerns of reverse causality for our estimation exercise, the explanatory variables are lagged. To mitigate lingering concerns that a bank's market power may be spuriously correlated with its lending-funding growth gap, we use activity restrictions as an instrumental variable to extract exogenous variation in market power as in Barth et al. (2013). The presumption is that countries with higher activity restrictions create fragmented markets that allow banks to exert monopolistic power.

Furthermore, to control for unobserved heterogeneity, we exploit the multi-level structure of our data set to mitigate omitted-variable bias in a fashion similar to Sette and Gobbi (2015). More specifically, our bank-year-country sample allows the inclusion of "high dimensional" bank, year and country*year*specialization fixed effects, saturating our analysis from other unobserved heterogeneity within the bank (time-invariant), year (common shocks) and country-year-specialization (time varying macroeconomic conditions). As the omitted variable bias would amplify any endogeneity problems, our careful treatment here also serves to further alleviate such concerns.

We find that the higher the market power for the average bank, the lower is the growth rate of lending relative to deposits. As a result, higher market power for the average bank may act to amplify adverse effects during periods of deposit decline while smoothing positive shocks and reducing the build-up of risk when deposits are growing. At very high levels of market power, however, there is a threshold past which the effect of market power on the growth rate of lending relative to deposits turns positive. Thus, for "superpower" banks, market power improves smoothing-ability during periods of deposit decline in relatively bad times while leading to amplification and to risk accumulation when deposits are growing. Strikingly, amplification and risk accumulation during such periods also characterize banks facing high competition. The much stronger effect of market power we find for periods of deposit decline as compared to periods of deposit growth, however, implies that the helpful role of competition and "superpower" when deposits are falling matters more than their role for amplification and risk accumulation when deposits are growing.

The paper is organized as follows. In Section 2, we explain the basic theoretical framework motivating our empirical analysis and derive testable hypotheses. Section 3 describes how we construct our dataset along with our estimation procedure. Main empirical results are presented and discussed in Section 4. Section 5 discusses implications for corporate financial decisions, relationship banking, and the macroeconomy, while section 6 briefly concludes.

2 The lending-funding growth gap

We begin this section by presenting our variable of interest, the *lending-funding growth gap*, and showing how it relates to smoothing, amplification, and the build-up of liquidity risk. We then discuss the potential effects of market power on the lending-funding growth gap. Auxiliary discussions and intermediate derivations are in Appendix A.

2.1 Smoothing, amplification, and risk accumulation

As financial intermediaries, banks accept deposits and provide loans. Since there is a large number of customers on both sides of this process, idiosyncratic shocks to deposits can typically be diversified out (Diamond and Dybvig, 1983; Bencivenga and Smith, 1991), rendering the overall deposit intake mostly dependent on systemic shocks. Our question is, therefore, which banks possess a better capacity to protect their lending function from these shocks to their funding arm, to which we refer as the "smoothing" capacity. An opposite situation, when a funding shock translates into an even greater shock to lending, may be referred to as "amplification". We discuss the two effects in more detail below.

Our main interest relates to the impact a *change* in deposits might have on a bank's lending, for which reason we will focus on the growth rates of the two variables.[6] We measure the sensitivity of lending to changes in deposits using the linear difference between the loan and deposit growth rates[7], which we call the *lending-funding growth gap*,

$$l_t - d_t = \frac{L_{t+1} - L_t}{L_t} - \frac{D_{t+1} - D_t}{D_t}, \tag{1}$$

where L_t and D_t are, respectively, the observed values of total loans and total deposits a bank has in period t. We interpret the lending-funding growth gap as the sensitivity

[6] Drechsler et al. (2017) study the impact of a change in deposits on the lending function, yet their focus is on lending growth, testing the impact of a change in the Federal Funds rate on lending through deposits. Differences between the *levels* of long-term assets and short-term liabilities have been used in the literature to describe the maturity transformation function of banks (see e.g. Flannery and James (1984), or Brewer et al. (1996)). Differences between the levels of liquid and illiquid assets and liabilities have been used to measure liquidity creation by banks (Berger and Bouwman, 2009).

[7] Alternatively, the sensitivity of lending to deposit shocks can be measured by the elasticity of lending to deposit inflow, as done for example in Jayaratne and Morgan (2000) with an emphasis on this parameter's relationship to bank capitalization. However, this measure is not well behaved for near-zero deposit growth rates (note that the average rate of deposit growth in our sample is 8.22% per annum, with a standard deviation of 19.93). See also further discussion in Appendix A.

of loan growth to a change in deposit growth. If the latter is driven by an exogenous shock, the change in the bank's lending can be seen as a response to this shock. More precisely, if $\frac{L_t}{D_t}$ is the previous period's loans-to-deposits ratio, then condition $l_t - d_t = 0$ is equivalent to dedicating to new loans $\Delta L_{t+1} = L_{t+1} - L_t$ exactly the same proportion of the new intake of deposits, $\Delta D_{t+1} = D_{t+1} - D_t$, as in period t:

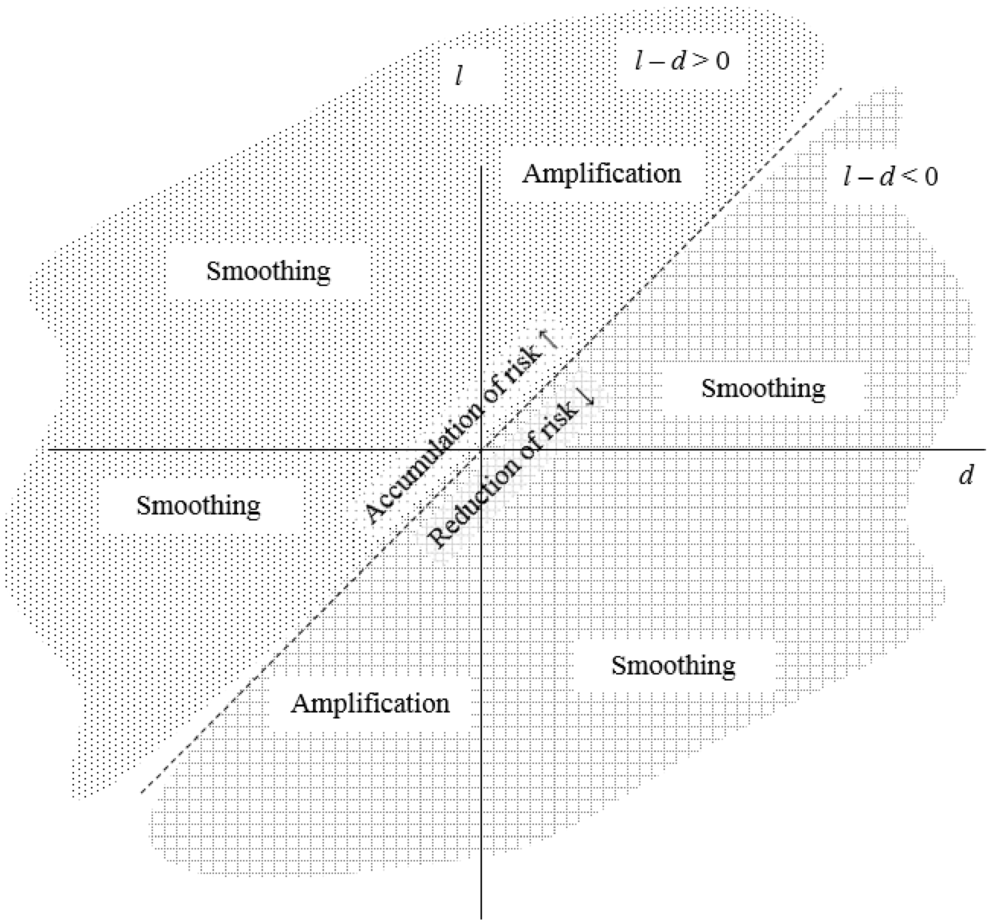
$$l_t - d_t = 0 \Leftrightarrow \Delta L_{t+1} = \frac{L_t}{D_t} \cdot \Delta D_{t+1}, \tag{2}$$

Deviations from this, as given by $l_t - d_t < 0$ and $l_t - d_t > 0$, correspond to a sub-proportional or a more-than-proportional increase in lending in response to a change in deposits and will be the primary focus of our analysis. Note that the variable $l_t - d_t$ already takes into account that not every dollar of new deposits needs to be converted to a new dollar of loans. Instead, it gives us a picture of whether more or fewer dollars from each new deposit are used for lending in period $t + 1$ as compared to period t.

Implications of having a positive or a negative $l_t - d_t$ are different in situations of falling or growing deposits. A positive growth gap, $l_t - d_t > 0$, means a lesser decline (or even an increase) in lending than a given decline in deposits, $d_t < 0$, and hence represents smoothing provided by banks to an economy experiencing a shock that leads to a decline in deposits. A negative growth gap under the same circumstances would instead imply amplification of this shock, as lending would be declining faster than deposits. On the other hand, when deposits go up, a negative $l_t - d_t$ would dampen any impact of deposit growth on the economy which is also a form of smoothing, while a positive $l_t - d_t$ would lead to amplification.

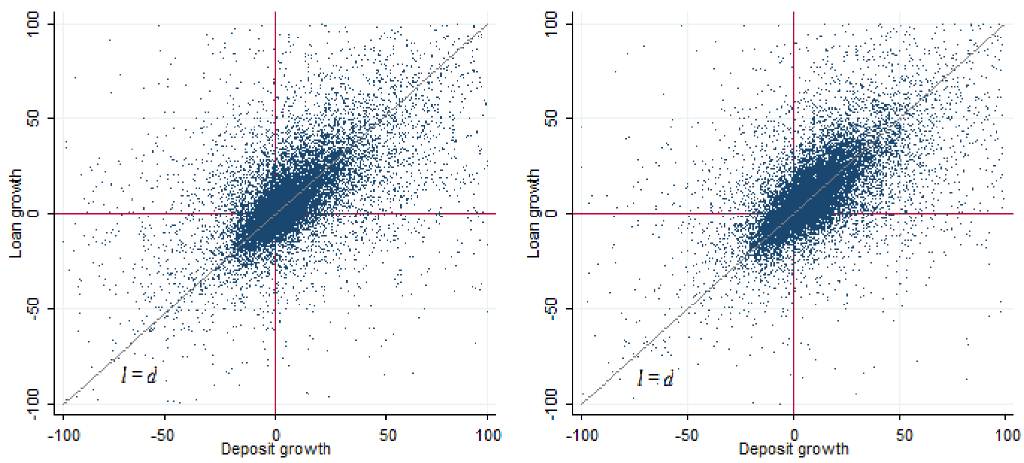
Figure 1 reflects this asymmetric interpretation of $l_t - d_t$ in times of growing deposits and in times of declining deposits. Figure 2 plots loan growth versus deposit growth in the worldwide sample of banks we use later for the analysis, separately for banks with low (below median) and high (above median) market power (see Section 3.2 for details).

Figure 1: Loan growth (l) versus deposit growth (d).



Notes: Dashed line corresponds to $l = d$. The ability to generate more loans than acquired deposits, $l - d > 0$, is interpreted as the accumulation of liquidity risk and at the same time as smoothing for negative deposit shocks ($d < 0$) and as amplification for positive shocks ($d > 0$). Negative growth mismatch, $l - d < 0$, corresponds to a reduction in liquidity risk and the opposite interpretation of smoothing and amplification for $d < 0$ and $d > 0$ to the one described above for the $l - d > 0$ case.

Figure 2: Loan growth versus deposit growth worldwide.



(a) Below median market power (b) Above median market power

Notes: The figure plots loan growth versus deposit growth for individual bank/year observations with below and above median market power, as measured by the Lerner index. Sources of data and variables are defined in Section 3.2

For both types of banks, observations align around the 45° line, as introduced in Figure 1. Still, variations around this line are pronounced in both subsamples and include a number of implications with regards to the smoothing/amplification capacity of banks. These implications are highlighted in Figure 1. In particular, an increase in $(l_t - d_t)$ in times of declining deposits improves the smoothing capacity of banks or reduces their contribution to the amplification of the business cycle; the opposite applies in times of rising deposits.

The above considerations refer to the role banks play in driving the business cycle in the short run, having in mind an instantaneous response of lending to a change in deposits. In the long run, however, having persistently positive or persistently negative $l_t - d_t$ has implications for the build-up of liquidity risk, as measured by the relative "customer funding gap", $\frac{L_t - D_t}{L_t}$. The latter is employed by policy-makers and researchers alike as an indicator of the systemic risk (BoE, 2010; Allen et al., 2012; Albertazzi and Bottero, 2014) and is related to the Net Stable Funding Ratio (NSFR), a core stability indicator adopted as a standard minimum requirement in the Basel III framework since January 2018, described in more detail in Appendix A.

2.2 Impact of market power

We now link the lending-funding growth gap to banks' market power. Consider a bank funded at time t by deposits D_t and other sources of finance K_t, such as interbank borrowing, debt finance, and capital accumulation. Deposits are subject to exogenous shocks. As they represent a significant portion of the bank's liabilities, these shocks may be transmitted to the bank's investment decisions through the balance-sheet constraint. The bank performs qualitative asset transformation and in doing so chooses fraction α_t of its funds to be invested in risky loans L_t, with the remainder invested in a diversified portfolio of market securities:

$$L_t = \alpha_t \cdot (D_t + K_t) \,. \tag{3}$$

We denote $k_t = \frac{K_{t+1}-K_t}{K_t}$ the growth rate of funding from other sources, $g_t = \frac{(D_{t+1}+K_{t+1})-(D_t+K_t)}{D_t+K_t}$ the growth rate of the overall size of the bank $(D_t + K_t)$, and $a_t = \frac{\alpha_{t+1}-\alpha_t}{\alpha_t}$ the percentage change in the fraction of loans in the bank's portfolio from t to $t+1$. Re-writing (3) in growth rates and subtracting d_t, the growth rate of deposits, from both sides yields

$$l_t - d_t = a_t \, (1 + g_t) + \phi_t \cdot (k_t - d_t) \,, \tag{4}$$

where $\phi_t = \frac{K_t}{D_t+K_t}$ is the leverage parameter, referring to the bank's current reliance on "alternative funding" as a source of finance. Equation (4) relates our variable of interest to the main parameters of the bank: portfolio adjustment a_t, overall balance sheet growth g_t, leverage parameter ϕ_t, and "access to alternative (non-deposit) sources of funding" k_t. At the beginning of period t, parameter ϕ_t is fixed by the existing levels of K_t and D_t and is independent of their growth. Thus, ϕ_t is not a forward-looking decision variable. The right-hand side in (4) highlights that smoothing can be achieved via two main channels: either through portfolio rebalancing (via changes in a_t), or through borrowing/recapitalization by resorting to alternative non-deposit sources of funds (via changes in k_t).[8] If market power affects the lending-funding growth gap, it should affect one or both of the above channels. This is what we are about to investigate.

A similar decomposition of the impact of market power on banks may be found in studies of the relationship between competition and risk-taking. For the portfolio channel, a large strand of the literature reviewed in Boyd and De Nicolo (2005), suggests competition drives banks into more risk-taking. Boyd and De Nicolo (2005) propose this relationship can reverse if the riskiness of assets is endogenous to banks' pricing decisions. Building on this, Martinez-Miera and Repullo (2010) demonstrate the relationship is inherently non-linear: on the one hand, banks with more market power can indeed charge higher interest rates on loans, imposing higher risk of borrowers' bankruptcy (amplified by moral hazard), while on the other hand banks with higher market power can use increased revenues from these higher rates to add capital, providing a buffer against losses thus reducing banks' riskiness. Monopolistic banks exhibit conservative behavior as they value and want to preserve monopoly rents. The former "risk-shifting effect" is thus counteracted by the latter "margin effect". The former effect is part of the portfolio rebalancing channel in our terminology, while the latter effect where revenues

[8] As Wheelock and Wilson (1995) note, "...significant deposit withdrawals may force a bank to borrow against its loan portfolio or to sell assets." In Choudhary and Limodio (2017), an increase in deposit volatility acts as a risk factor for the portfolio choice, triggering an increase in the lending rate of long-term loans through which the average maturity of the portfolio shortens in equilibrium. As only the second moment of deposits changes in their set up, there is no change in the overall lending; access to liquid funds, which corresponds to "alternative sources", obliterates the effect.

are used to top up capital, is part of the recapitalization channel. The channels cannot be fully disentangled in Martinez-Miera and Repullo (2010) as banks in their model decide only on the supply of loans, which simultaneously affects the return and risk of the loan portfolio as well as the revenue generated. Extending the set of a bank's decision options allows focusing on each of the channels separately. Below we discuss how each of them can produce a non-linear relationship between market power and the lending-funding gap. In our set up, the two channels will reinforce rather than offset each other.

The portfolio rebalancing channel

Portfolio rebalancing, captured by a_t in equation (4), refers to the bank's choice between the accumulation of liquid assets and selling liquid assets to facilitate lending. A bank can potentially resort to this source of liquid funds at any point as long as regulatory liquidity constraints are not binding. The decision to rebalance thus mainly depends on the bank's willingness to take on risks.

In Martinez-Miera and Repullo (2010), the "risk-shifting effect" arises through an increase in the probability of a loan failure when interest rates on loans rise due to higher market power. Conversely, the probability of a loan failure falls when interest rates on loans drop due to higher competition. While higher competition ensures an increase in aggregate lending, for the average bank the supply of loans shrinks as the number of banks in the market increases. Thus, it would appear that *all other factors being equal*, the same bank placed in a competitive market would offer fewer loans than it would offer in a monopolistic environment, despite facing lower risk in a competitive loans market. The question is how this same bank would respond to a change in its available resources, such as a deposit outflow or inflow.

In this case, we would expect more competitive banks to exert more flexibility in adjusting their portfolios to support lending as they are less bound by risk considerations. First, they are already operating in a lower risk environment, thus they may extend more loans in response to an inflow of deposits, or prevent a reduction in lending by selling marketable securities in response to an outflow. Second, the same market forces that ensure lower loan rates would force competitive banks to use loanable funds for lending rather than for creating additional reserves.

Banks in less competitive markets deal with higher risk, which would imply more conservative behavior and less willingness to take on additional risk. We would thus expect these banks to be less willing to sell liquid funds to support lending. Note that Martinez-Miera and Repullo (2010) obtain that in monopolistic markets, risk-shifting induced by increasing market power plays an even more important role than revenue generation from loan repayments. This reinforces our point that portfolio risk for these banks is high and thus becomes a binding constraint for portfolio adjustments.

The above argument holds, however, only if risk indeed increases with market power. This result in Martinez-Miera and Repullo (2010) derives from the assumed relationship between loan pricing and the quality of loans: moral hazard and adverse selection imply that the probability of default increases in the loan rate. On top of affecting loan prices, banks can affect the quality of their portfolio by other means: screening, monitoring and improving the quality of borrower selection to avoid the adverse selection trap, are rather standard examples. These tools counteract the risk-shifting effect of market power and fall within the portfolio rebalancing channel in our set up. The margin effect suggested by Martinez-Miera and Repullo (2010) falls within the recapitalization channel in our set up. We discuss this in the next sub-section.

While standard tools may be equally available to all banks, an important determinant of loan portfolio quality is the choice of lender by borrowers: good quality borrowers may self-select to do business with a particular bank. Much of the literature focuses on the firm's choice between bank financing and publicly offered debt. In Yosha (1995) good quality firms may prefer bank financing if having the bank as a single lender ensures information about the firm's business plans is not disclosed to competitors. Leary (2009) emphasizes that larger firms can substitute bank financing with publicly offered debt if banks change lending conditions. In Rajan (1992) banks monitor and control firms' investment decisions, yet also affect how profits are distributed between the lender and the borrower; the latter makes firms turn away from banks. Arguably, banks with high market power can offer these customers more flexible conditions to ensure they will choose bank loans over publicly offered debt. This flexibility is emphasized in the literature on relationship lending, where firms prefer ties with monopolistic banks (Petersen and Rajan, 1995) because the latter may offer credit when needed and because monopolistic banks can strategically misprice loans making them more attractive at the beginning of the relationship (see also Degryse and Ongena (2005)). According to the literature, these tools are more readily available to banks with higher market power. Thus, we expect such banks to have a better choice of borrowers.[9] While for banks with middle-range market power these mechanisms may not be prevalent enough to counteract the earlier discussed risk-shifting effect, more powerful "superpower" banks would have an advantage in this case, allowing them to alleviate the risk problem and thus use liquid assets to support lending during deposit downturns.

To sum up: competitive banks are price-takers, charge competitive rates on loans, and are less affected by moral hazard and adverse selection problems so that they face lower risk. However, these banks also face low profitability and market pressure to lend more. Banks with some market power are capable of charging higher interest rates on

[9] See, e.g., Jiménez et al. (2013) who demonstrate using Spanish data that higher market power is associated with less risky loans.

loans but do not have enough market power to be very selective. Thus, these banks may face a higher risk than competitive banks and might be less flexible in lending decisions. Finally, superpower banks can be very selective and enjoy a higher variety of tools that ensure a better quality of borrowers. These banks may also enter into long-term relationships with borrowers, and can be more flexible regarding pricing and lending decisions. The portfolio rebalancing channel thus implies a non-linearity in the effect of market power on the lending-funding growth gap. That is, competitive banks and "superpower" banks would be more able to support lending via their accumulated liquid assets, as compared to banks with some limited market power.

The borrowing/recapitalization channel

The *margin effect* discussed in Martinez-Miera and Repullo (2010) is based on the assumption that banks with some monopolistic power use revenues from high non-competitive loan rates to make loan loss provisions. For banks that enjoy a sufficiently high level of market power, an increase in competition may have little impact on their ability to create reserves. For more competitive banks, however, a further increase in competition can be detrimental to the accumulation of reserves. This might explain why Martinez-Miera and Repullo (2010) find that the margin effect dominates in competitive markets.

Since retained earnings and reserves are part of banks' Tier I capital (see BIS (2010)), we consider this risk management tool as falling within the "recapitalization" channel. Note that along with providing a cushion against loan losses, retained earnings and accumulated reserves may serve as a buffer to compensate for the outflow of deposits if banks wish to maintain their level of lending. Other methods to support lending available to banks, captured by k_t in equation (4), include banks' capital as well as funds banks obtain by borrowing from other financial institutions (e.g., interbank borrowing) and from the wider market by issuing bonds and other securities. We can distinguish between three scenarios:

1. The bank has no access to "alternative sources", $\phi_t = 0$ hence $l_t - d_t = a_t\,(g_t + 1)$, so that smoothing can only be achieved through portfolio rebalancing as represented by changes in a_t. Here, the bank sells safe assets in order to grant more loans.

2. The bank has limited access to "alternative sources": these represent a non-negligible fraction of funding, $\phi_t > 0$, but cannot be *endogenously* changed in the short term, $k_t = 0$. To smooth the impact of a decline in deposits, this bank needs to sell less safe assets than if it had no access to alternative sources: $l_t - d_t = a_t\,(g_t + 1) - d_t \cdot \phi_t$. Here, alternative funding provides a cushion against shocks through diversification of liabilities, thus lessening their impact on lending.

3. The bank has unconstrained access to "alternative sources"and can freely choose the amount of funding obtained from such sources at any point in time, $\phi_t > 0$ and $k_t \in \mathbb{R}$. Such banks can resort to alternative funds to compensate for the shortage of deposits.

One of our central hypotheses to be tested is whether market power can help banks reduce the impact of deposit fluctuations on lending. The three scenarios above demonstrate this may be due to differences in banks' ability to obtain funding from "alternative sources". For example, Fonseca and González (2010) provide empirical evidence of a positive relationship between bank market power and their capital buffers.[10] The main reasons for market power to affect the ability of banks to raise funds are: reputation

[10] Analyzing implications of the no capital assumption for their model, Martinez-Miera and Repullo (2010) note that "for sufficiently high franchise values bank shareholders may want to contribute some capital in order to reduce the probability of losing the franchise" (p.3663), which also indicates that higher market power makes it more likely that banks can get recapitalized.

(as banks with higher market power are less likely to invoke reliability concerns on the side of lenders), higher net present value (as banks with higher market power are usually associated with better ability to screen and monitor borrowers), and competitive pressure. The first two effectively reduce the cost of access to and utilization of alternative sources of funds for banks with higher market power. As for the third one, Berger et al. (2019) study the impact of competition on banks' decisions to hold capital in excess of regulatory requirements. They show that competitive banks, driven by the search for growth opportunities, have higher target capital ratios and achieve this mainly through active capital management including the issuance of new liabilities, repurchases, and changes in dividend policy. They also find that competitive banks are more flexible and adjust their capital faster.

While it may be true that banks with very high market power ("superpower" banks) can manipulate the market and in particular use ties and connections to enable inflow of funds when necessary, this would be less likely for banks that have *some* market power but not enough to have strategic influence on other market participants. Banking sectors across the globe are usually not perfectly competitive, yet only a few banks enjoy superpower. For the remainder of them, we expect that competition rather than market power would force them to more actively manage their capital. Thus, the borrowing/recapitalization channel induces a non-linearity in that competitive banks and "superpower" banks are better equipped than banks in the middle of the market power spectrum to obtain funds and facilitate lending.

Hypotheses

The portfolio rebalancing channel along with the borrowing/recapitalization channel both imply a non-linearity in the relation between market power and smoothing ability. The two channels reinforce each other and provide us with Hypothesis 1 below.

Hypothesis 1 *The impact of market power on the lending-funding growth gap is U-shaped: higher market power reduces the gap except at very high levels of market power.*

To disentangle the two channels, portfolio rebalancing and borrowing/recapitalization, we note that banks would have different strategic considerations and incentives to seek alternative funding depending on whether they expect an outflow of deposits or whether deposits are projected to grow. The reason for this is the feasibility and cost of the two mechanisms. Portfolio rebalancing is a reversible and often cheaper option due to the liquid nature of assets involved.[11] By contrast, a quick arrangement for an inflow of funds from other non-deposit sources is not always feasible especially if these require issuing financial instruments like bonds or equity. Once financing arrangements are made, these are irreversible until the maturity of debt instruments involved or until a buyout is arranged.

When deposits fall, banks seek to activate both channels, borrowing/recapitalization and portfolio rebalancing, and market power comes into play: "superpower" banks can more easily arrange funding from alternative non-deposit sources via the borrowing/recapitalization channel, and have reserves to re-balance. When deposits grow, banks are not credit-constrained thus they are not as keen on looking for and/or exploiting existing sources of finance. Raising funds would exhaust sources of funding that cautious banks would perhaps like to keep available for "bad times" when deposits fall. Portfolio rebalancing remains, however, a feasible option. Competitive banks could reduce safe assets to fund more loans as in the literature on competition-fragility. By contrast, banks with higher market power already enjoy higher than competitive revenues and have less of a need to use the momentum to generate extra profits. Costly

[11] Theoretically, to manage the quality of assets, especially when the resource base shrinks, banks may call in loans which is highly costly. The existence of this option does not undermine our main argument: while such a costly option exists, it is complemented by cheaper and easier solutions. It is the existence of relatively cheap solutions that constitutes the core of our argument.

access to funds would prevent them from expanding their lending even though risks are lower. Nevertheless, "superpower" banks are unconstrained in their access to alternative sources of funds so they can use these to exploit the momentum and raise their market share.

Thus, we expect a non-linear relationship as in Hypothesis 1 for both booms and busts in the deposit market, albeit with qualitative differences. Although dissimilarities across banks with various degrees of market power may still exist during periods of deposit growth, they would be less pronounced as compared to periods of falling deposits due to the reasons analyzed above. This asymmetry can be informative about the roles of the two channels, i.e., access-to-funds versus portfolio rebalancing. If alternative non-deposit sources of funds via the 'borrowing/recapitalization' channel were negligible, as might be implied, e.g., by the work of Drechsler et al. (2017), only the portfolio rebalancing channel would matter and we would then expect a more symmetric response to deposit growth and declines than we actually observe in the data.[12]

Hypothesis 2 *The relationship between market power and the lending-funding growth gap is asymmetric: it is stronger in periods of falling as compared to periods of rising deposits.*

An important take-away from this section is that a positive impact on the smoothing variable during periods of deposit booms can be seen as amplification of shocks. However, based on the preceding analysis, this may be less of a concern in terms of macroeconomic effects as the impact of market power is expected to be smaller when deposits grow.

[12]The asymmetry we hypothesize in Hypothesis 2 and later report in Section 4 nevertheless suggests that the access-to-funds ('borrowing/recapitalization') channel is non-negligible.

3 Estimation and Data

3.1 Estimation

To assess the smoothing capacity of banks, we consider the sensitivity of the lending-funding growth gap in relation to a bank's market power and other bank and market characteristics. We thus estimate the following regression equation as our baseline:

$$[GL_{i,j,t+1} - GD_{i,j,t+1}] = \alpha_f + MP_{i,j,t} + MP^2_{i,j,t} + X_{i,j,t} + Z_{j,t} + \varepsilon_{i,j,t} \qquad (5)$$

where the difference in the growth rates between loans ($GL_{i,j,t+1}$) and deposits ($GD_{i,j,t+1}$) for bank i in country j between periods t and $t+1$ is regressed on market power ($MP_{i,j,t}$), market power squared ($MP^2_{i,j,t}$) to capture non-linear effects, a vector of bank characteristics $X_{i,j,t}$ including non-performing loans, bank size and other bank-specific controls, a vector of country characteristics $Z_{j,t}$ including concentration ratios, the GDP growth rate to capture business cycle effects on net loan growth, and other country-specific controls.[13] Finally, α_f denotes a vector of fixed effects, while ε is a bank-country-level shock capturing stochastic disturbances.

In equation (5), reverse causality could emerge if the difference in the growth rates of loans and deposits affects our measure of market power. The literature commonly employs lagged explanatory variables to mitigate endogeneity issues that emerge due to reverse causality (e.g., Beck et al. (2013)). To alleviate concerns of reverse causality, all the right-hand side variables except non-performing loans are lagged once. In addition, we use activity restrictions and supervisory power at the country-year level in order to obtain exogenous variation in market power as in Barth et al. (2013). The presumption here is that countries with higher activity restrictions and supervisory power create

[13] We change notation at this point to emphasize the distinction between equation (4) that provides a theoretical justification of the two main channels via which market power can affect net loan growth, and the empirical approach chosen to test the relationship as given in regression (5). Market power enters the latter explicitly while it only implicitly affects the components on the right-hand side of the former.

fragmented markets that might allow banks to exert monopolistic power due to their specialization.

As the bank's lending portfolio depends on loan quality, we would expect the difference in the growth rates of loans versus deposits to positively depend on loan quality. To account for this, in the subsequent analysis we control for loans' quality as proxied by the share of non-performing loans (NPLs) at the beginning of each period t. The rationale for including NPLs is that when the prevalence of non-performing loans in the economy is low, banks would need to make less provisions which would enable them to increase loan growth for any given rate of deposit growth. The portfolio choice of the bank depends on the quality of loans; the higher the latter, the more likely the bank is to substitute falling deposits with funds obtained through sales of safe assets in order to reduce the impact on the total quantity of loans provided. Assuming the quality of loans can be captured by the percentage of non-performing loans, banks with low NPLs should be more likely to provide effective smoothing. As a robustness check, we also consider loan loss provisions made by bank i in country j at time $t-1$, as an alternative to non-performing loans. We expect a weakened effect of the quality of previous loans on current lending decisions in periods when deposits grow, to the extent that the latter is associated with an improvement in economic conditions and a general reduction in economic risks.

We would also expect larger banks to have better access to alternative funds and to thus be more likely to provide effective smoothing. This could be due to scale economies that reduce the relative cost of relevant arrangements on them. Noting that size is endogenous to past profit growth which is in turn related to market power, having included a direct measure of the evolution of market power over time, size will thus largely capture aspects driving lending relative to deposit growth unrelated to market power. Thus, the main role of size would, in this case, be via its cost-reducing effect on banks' access to funding. If the benefits banks derive from economies of scale and scope are asymmetric between the lending and funding arms, and the channels (rebalancing versus borrowing/recapitalization) are differently activated when deposits go up or down, we ought to observe a differential impact of bank size on our main variable of interest.

We expect economies of scale to be more pronounced in lending activities (large banks have advantages in attracting new borrowers) than in funding (reputation aside, large banks may save on costs of searching for potential funders, yet securing a large amount of funding may be more complicated). With this in mind, if the borrowing/recapitalization channel was of lower importance and portfolio rebalancing was the major mechanism governing net loan growth $(l - d)$ when deposits grow, then we should expect economies of scale and hence the size of financial institutions to matter more in periods of growing deposits than in periods of declining deposits. A similar argument, with an opposite sign, would apply if economies of scale were more pronounced for funding than for lending activities. The empirical literature leaves us largely agnostic with regards to activity-specific scale economies, however we can expect an asymmetric role of size, depending on whether deposits grow or decline.

As our theoretical predictions are different for episodes of declining and growing deposits, we estimate the above equation for two subsamples, where bank-year observations are split according to the sign of the deposit growth variable. That is, we consider the behavior of $GL_{i,j,t+1} - GD_{i,j,t+1}$ during episodes of falling and rising deposits separately. This can potentially help uncover important asymmetries in line with our theoretical exposition in the previous section.

Finally, omitted variable bias could arise if there were unobserved bank-country-year factors affecting banks' market power (e.g., specific unobserved elements of the tax system, ability to carry out profit shifting and/or portfolio diversification). On this front, the structure of our sample allows the inclusion of bank, year, and country×year×specialization high dimensional fixed effects. These fixed effects saturate our analysis from other unobserved heterogeneity within bank (time-invariant), year (common shocks) and country-year-specialization (time-varying macroeconomic conditions). As omitted variable bias would amplify any endogeneity problems, our careful treatment here also serves to further alleviate such concerns.

3.2 Data

For the construction of the dataset, we rely on Bankscope as our primary source of bank-level data. Our data set includes data for 8,477 banks in 129 countries, available annually for the period 1992-2015. We exclude earlier years because of concerns associated with coverage and accounting issues. We include only countries that have at least three banks in each year of our panel. Our focus is on commercial, savings and cooperative banks. We exclude real estate and mortgage banks, investment banks, other non-banking credit institutions, specialized governmental credit institutions, and bank-holding companies. The excluded institutions are less dependent on the traditional intermediation function and have a different financing structure compared to our focus group. In short, our focus in this study is on banks carrying out traditional banking activities. We apply three further selection rules to avoid including duplicates in our sample.[14]

First, even though we do not include bank-holding companies, we still need to exclude double entries between parent banks and subsidiaries. We use either the consolidated or the unconsolidated statement depending on which one is available. This is a non-trivial process that requires the re-examination of all banks on an individual basis to avoid double-counting. Notably, there are cases of banks with subsidiaries in domestic or in

[14] As argued in Delis et al. (2016), this is a key part of the sample-selection process absent from most empirical studies using the Bankscope database.

foreign countries and one should be careful to avoid double-counting of subsidiaries that are established, e.g., in foreign countries.[15]

Second, we account for mergers and acquisitions (M&As). We went through all the M&As one-by-one and made sure that both banks appear separately in the sample before the M&A and only the merged entity or the acquiring bank is included in the sample after the event. For example, if bank A and bank B merged in 2005, we create a new entity AB after 2005 and exclude the separate financial accounts of A and B that might still be reported for some time after the merger. We identify M&As and their timing using Bankscope and the websites of the merging parties. Third, in the US there are many distinct banks that have the same name but are active in a different state. To solve this issue, we relate the value of total assets of, say, bank i in the last year this bank appears in our sample with Bankscope's identification number for bank i. This also allows avoiding problems with our procedure concerning M&As described above. As a final step, we winsorized our sample from outliers at 1% (Delis et al. (2016)).

Sources of the variables used in the empirical analysis and their definitions are summarised in Table 1. Table 2 presents summary statistics. In Appendix C1, we additionally present the total number of banks in our sample by year, and the correlations of the main variables.

[Please insert Table 1 about here]

[15] Let us provide some examples to clarify this point. Assume that bank A_1 is the parent bank with a consolidated (C) statement and banks A_1^1, A_1^2 and A_1^3 are subsidiaries and unconsolidated (U) statement. If we include all banks in our sample we will have 3 duplicates. Hence, we need to subtract either the percentage of the subsidiaries or to exclude the subsidiaries from the sample. The former solution is not feasible because we do not have enough information for the percentage and the time duration of the ownership of the subsidiaries, thus we resort to the latter solution. Two other examples for the case of banks with foreign subsidiaries that we account for using the same strategy are (i) B_1 is a parent bank with a C statement, B_1^1 is a subsidiary bank operating in the domestic market with a C or a U statement and $B_1^{1,1}$ is a sub-subsidiary bank operating in the domestic market and (ii) B_1 is a parent bank with C statement, B_1^2 is a subsidiary bank operating abroad with a C or a U statement and $B_1^{2,1}$ is a sub-subsidiary bank operating in the domestic market with a U statement.

[Please insert Table 2 about here]

3.3 Measures of market power

The measurement of market power has received much attention in the literature. The Lerner index (Lerner (1934a)) remains a popular measure of market power due to its simplicity and transparency. It is defined as

$$L_{ijt} = \frac{P_{ijt} - MC_{ijt}}{P_{ijt}} \quad (6)$$

where P_{ijt} and MC_{ijt} are the price of bank output i in country j at time t and the marginal cost of the production of this output, respectively. The Lerner index ranges between zero and one, with zero corresponding to perfect competition and larger values reflecting more market power (and less competition). The index can also be negative if $P_{ijt} < MC_{ijt}$, which is of course not sustainable in the long run.

The Lerner index has a number of characteristics that make it an appealing measure of market power. First, it measures departures from the competitive benchmark of marginal cost pricing. This makes it a simple and intuitively appealing index of market power (competition). Second, it is perhaps the only structural indicator of market power that can be estimated at the bank-year level. This is quite important for the purposes of our study, as the unit of our analysis is at the bank-country-year level. Third, as Beck et al. (2013) argue, the Lerner index is a good proxy for current and future profits stemming from pricing power. Moreover, it captures both the impact of pricing power on the asset side of the bank's balance sheet and the elements associated with the cost efficiency on the liability side.

Constructing the Lerner index requires knowledge of marginal costs. When this information is unavailable, marginal costs can alternatively be obtained by econometric estimation. A popular approach has been to estimate a translog cost function and take its derivative to obtain the marginal cost. Recent work has shown that one can improve on this using semiparametric or nonparametric methods that allow for more flexibility in the functional form (Delis et al., 2014, 2016). We follow the approach from Delis et al. (2016), and report annual averages of the Lerner index in Table C4 of the Appendix. In Appendix B, we provide details for the semiparametric estimation of a log-linear cost function.

The semi-parametric nature of the method implies no global assumptions need to be made regarding the functional form of the cost equation. We just make assumptions in local neighborhoods of observations, which is important given how difficult it is to be certain about the validity of any chosen functional form. The flexibility of the semiparametric technique also allows using large international samples of banks from different countries, without being concerned that certain banking markets in different countries or banks within the same country face or adopt different production technologies. Hence, this approach can take into account the heterogeneity in the production technology across banks, countries, and time.[16]

4 Results

4.1 Market power and smoothing

Our baseline regression equation (5) serves to assess the potentially non-linear effect of market power stated in Hypotheses 1 and 2. However, in order to emphasize the importance of considering the non-linear effect of market power, we begin by considering a shorter specification omitting non-linearities and other theory-implied variables next. This will then serve for comparison with the results arising from estimating the more complete specification described in equation (5).

[16]We examine the sensitivity of our results to the use of different variants of the traditional Lerner index and other alternatives measures of market power like the Boone indicator.

The first specification we estimate, shown in column I of Table 3, considers the effect of the Lerner index on the lending-funding growth gap controlling only for loan quality and time effects, omitting non-linearities and other theory-implied variables. Subsequently, we allow for country, specialization, and bank fixed effects (column II), and the interaction of the first two with time effects (column III).

In Table 3, we find that higher market power reduces the lending-funding growth gap. This can occur via a greater fall in lending for banks with higher market power as deposits fall, or via a lower increase in lending as deposits increase. This is consistent with the negative impact of marker power on the lending-funding gap that forms part of Hypothesis 1. However, these estimates cannot inform us about the essential part of Hypothesis 1 that pertains to the presence of non-linearities, as they do not capture the case of "superpower" banks.

[Please insert Table 3 about here]

The separate estimation for periods of declining and growing deposits ("Deposits DOWN"and "Deposits UP", respectively in the table) confirms the above-described finding, yet this linear estimate lends little support to our Hypothesis 2 which predicted that the role market power plays in episodes of deposit outflows is greater than in periods of deposit outflows. This particular asymmetry is not evident when we compare columns IV-VI to columns VII-IX of Table 3. As we show next, this is due to the omission of the non-linear term here, suggesting non-linearity is crucial for this type of analysis.

We also find that an increase in non-performing loans limits a bank's ability to extend loans relative to its deposit inflows. In all specifications, the coefficients for the NPL variable have larger absolute values when deposits decline, consistent with our priors: the impact of the quality of loans on banks' smoothing ability appears stronger in periods of deposit decline. Our results are robust to controlling for a number of fixed effects, including country×year×specialization effects. This is evident in columns I-III of Table 3, as well as in columns IV-VI and VII-IX where we consider periods of declining and rising deposits, respectively.

Our baseline specification is given by regression equation (5) results for which are reported in Table 4. This extends the specification estimated in Table 3 by including a number of variables implied by theory, as motivated in our theoretical exposition previously. This involves the inclusion of bank-specific size and the country-specific business cycle over time, as well as the inclusion of the squared term of the Lerner index that allows for non-linear dependence of the lending-funding growth gap on market structure as postulated in Hypothesis 1.

As shown in Table 4, the square of the Lerner index enters positively implying that at high levels of bank market power, the negative impact of market power on net loan growth can be reversed. That is, at very high levels of market power, there is a threshold level past which the effect of market power on loan growth relative to deposits growth turns positive. This threshold is estimated, for example, to be equal to 0.37 in periods of deposit decline as shown in column VI of Table 4. The latter value is approximately one standard deviation above the mean value of the Lerner index for the banks in our dataset, with just 5 percent of banks in our dataset above this market power value.

The above effect of market (super) power on the lending-funding growth gap may be related to smoothing in the presence of falling deposits, and relates to amplification and risk accumulation over time in the case of rising deposits. For the great majority of banks, however, with levels of market power below the above-mentioned threshold value, the effect of market power on our main variable of interest is consistent with amplification of adverse effects during episodes of falling deposits, and with smoothing and a reduction in the build-up of risk during episodes of rising deposits. To distinguish between the impact of market power on smoothing versus amplification that applies to most banks and to “superpower” banks, we consider separately episodes of falling and rising deposits.

When we do so, we see that the impact of market power appears stronger during episodes of deposit outflows as compared to periods of rising deposits. This is evident in Table 4 comparing columns IV-VI with the respective columns VII-IX in each case, supporting our Hypothesis 2. This asymmetric effect of market power apparent in the second row of Table 4 suggests that the adverse role of market power for the average bank on smoothing when deposits are falling, matters more than the positive role of market power for the average bank on smoothing when deposits are growing.[17] Moreover, since in episodes of deposit outflows there is also a starker contrast between “superpower” banks and the other banks, indicated by a larger positive quadratic term in row 3 of Table 4 comparing columns IV-VI to columns VII-IX, the presence of “superpower” banks in a financial system will matter more for smoothing when deposits fall than for amplification during periods of rising deposits.

[Please insert Table 4 about here]

Moreover, as we can also see in Table 4, an increase in non-performing loans reduces the bank’s ability to extend loans relative to its deposit inflows, and apparently more so during periods of falling deposits. We note that this is more evident in specifications without GDP growth reported in columns V and VI for falling deposits and columns VIII and IX for rising deposits, where GDP growth is replaced respectively by country-year and country-year-specialization fixed effects. In these cases, the quality of loans evidently affects the $l - d$ gap differently depending on whether deposits grow or fall.

[17] More precisely, we refer here to the negative impact of market power on amplification associated with $l_t - d_t$ during episodes of deposit growth.

Furthermore, the positive contribution of GDP growth to the lending-funding gap both when deposits decline and when they grow (in columns I, IV and VI) is consistent with lending exhibiting positive co-movement with the country's business cycle, but also with medium-term output growth reducing overall risks and thus contributing to lending via portfolio re-balancing.

Finally, bank size typically affects $l_t - d_t$ positively, and more strongly so in periods of growing deposits. As shown in Table 4, this effect is smaller and statistically insignificant during periods of falling deposits. We note that as the Lerner index is included in the regressions in addition to bank size, the coefficient of bank size does not relate to market power here.[18] The estimated asymmetry here implies that aspects of size unrelated to market power, such as economies of scale, do not affect the lending-funding gap during periods of falling deposits, while having strong positive effects on it in periods of rising deposits. Based on our exposition in section 3.1, this is then consistent with economies of scale working more via the rebalancing channel while having no significant impact via the recapitalization channel. This underscores the dichotomy between market power effects, for which we have already identified a non-negligible borrowing/recapitalization channel, and economy of scale (bank size) effects which mainly work through the portfolio rebalancing channel related to the asset side of the balance sheet.

Overall, our baseline results in Table 4 support our Hypothesis 1 that more market power reduces the ability of the average bank to smooth deposit outflows while raising the ability of superpower banks to do so. Our baseline results also support Hypothesis 2 that the effect of market power on the lending-funding growth gap is asymmetric, with periods of falling deposits associated with the stronger impact of market power as compared to periods of rising deposits. These effects of market power are robust across

[18] Conversely, the estimated coefficients for the Lerner index capture market power aspects that affect loans relative to deposit growth but are not associated with the present size of the bank.

specifications.

4.2 Exogenous variation in market power due to regulatory changes

The economic mechanism we propose is that higher market power for the average bank may act to amplify adverse effects during periods of deposit decline, while smoothing positive shocks and reducing the build-up of risk when deposits are growing. One concern, however, is that banks market power might be determined simultaneously with the growth rates of loans and deposits. Differently phrased, one may raise doubts about the extent to which our results are solely driven by market power. In this subsection, we introduce an instrumental-variables (IV) methodology to address this concern.

To yield exogenous variation in market power, we follow Barth et al. (2013) in using activity restrictions at the country-year level. The activity restrictions index is defined as the regulatory restrictiveness for bank participation in (i) securities activities, (ii) insurance activities, (iii) real estate activities, and (iv) bank ownership of non-financial firms, with higher values reflecting more stringent restrictions. In addition, we use supervisory power that similarly reflects whether the supervisor has the authority to take specific action to prevent or correct problems.

In this manner, we exploit variation in banks' market power that is due to a recent change in activity restrictions or supervisory power. Our instruments are likely to satisfy the exclusion restriction because they affect banks' activities and actions in each country. We expect that countries with higher activity restrictions will create fragmented markets that might allow banks to exert monopolistic power due to their specialization. In addition, it seems less likely that these restrictions would affect banks funding gaps directly. One way that these indexes could be correlated with the funding gap is through common macroeconomic developments that tend to move together. We thus control for real GDP growth in our specification.

We conduct the IV-analysis using a two-stage least squares model with bank and year fixed effects. In Table 5, columns I-III, we replicate the baseline results of Table 4 using our instruments. In all specifications, we control in the first-stage regressions for the bank-country control variables and bank and year fixed effects.[19] The first-stage results in panel A are as expected and in line with Barth et al. (2013). We report the p-value of the Hansen test of overidentifying restrictions, which requires a value higher than 0.1 in order to accept the null (valid instruments) at the 10% level. The first stage coefficients and the Hansen test of over-identified restrictions show that there are no concerns regarding the validity of the instruments.

Panel B, presents the second stage estimates using the estimated values of the Lerner index and the Lerner index squared. The estimates are qualitatively and quantitatively similar compared to our baseline specification. Moreover, the statistical significance and inference on the non-linear relationship are very similar, with the turning point now equal to 0.31 in periods of deposit decline as shown in column II of Table 5.

4.3 Components

By definition, the variation in $l_t - d_t$ over time is due to changes in either of its two components.[20] Our argument refers to the degree to which banks adjust lending in response to a given change in deposits. Market power then affects the ability and willingness of banks to grant loans when the flow of deposits changes. It is, however, possible that market power also affects the inflow of deposits itself. To better identify the role of market power, we thus consider its effect on each of its two components, l_t and d_t, separately.

[19]We cannot include bank×year effects as these would completely absorb the country-year variation of our instruments.

[20]We note that $l_t - d_t$ does not differentiate between banks that sharply reduce lending due to a minor deposit outflow and those that keep lending unchanged when deposits grow, nor between banks that leave lending unchanged after a fall in deposits and those that sharply increase lending after a minor deposit inflow. To this effect, we have considered periods of declining deposits and rising deposits separately in the previous sub-section and Tables 3 and 4.

The component analysis presented in Table 6 demonstrates that market power affects lending much more strongly than it affects deposit-taking. In all specifications, the coefficient of the Lerner index for loan growth is at least twice as high as that for deposit growth. Moreover, the significance of this coefficient for loan growth remains strong at the 1% level throughout, while for deposits growth this is only 10% in the model controlling for country × year × specialization fixed effects shown in column VI of Table 6. Our findings here show that the adverse impact of market power for the average bank on loan growth is substantially bigger than its impact on the rate of growth of deposits. It follows that the impact of market power for the average bank on $l_t - d_t$ is primarily via its impact on the rate of growth of loans rather than deposits. Evidently, market power has its primary effect on smoothing via the lending channel. This is the case for banks with average market power, but as we can see by comparing the non-linear effect of the Lerner index on loan growth in the 3rd row of Table 6 (columns I-III) versus on deposit growth (columns IV-VI), this is also the case for "superpower" banks.

[Please insert Table 6 about here]

4.4 Maturity mismatch and type of loans

One intrinsic source of bank risk arises because their assets typically have a longer maturity than their liabilities (maturity transformation). In particular, the use of short-term deposits to finance long-term lending increases risk in the banking system. Having assembled data on deposits and loans maturities, we now consider these as proxies for the quality of liabilities and assets. In columns I and II of Table 7, we conduct an analysis comparable to the baseline reported in Table 4, but constructing the lending-funding growth gap using the subset of banks that report deposits with maturity longer than one year and loans with maturity longer than one year, respectively. This reduces our sample dramatically by several times relative to the baseline estimation exercise.

Nevertheless, our estimates for the impact of market power and market power squared remain qualitatively the same.

In the remaining specifications in columns III-VI of Table 7, we consider different types of loans to assess whether market power has a similar impact on the lending-funding growth gap constructed using growth rates for a particular type of loan. For these regression equations, we reconstruct the dependent variable replacing total loan growth with the growth rate of corporate, personal, and mortgage loans respectively.[21] This allows us to examine the effect of the Lerner index on the specific type of loan funding gap, controlling for bank and country * year fixed effects. Our estimates imply qualitatively similar results to the baseline ones regarding the effect of market power on the lending-funding growth gap, but quantitatively a somewhat lower impact of market power for corporate as compared to personal or mortgage loans.

[Please insert Table 7 about here]

4.5 Domestic demand and loan quality

The previous sections document the existence of the competition-funding gap relationship and offer insights into the drivers of this variation. However, one could argue that the results are driven by domestic demand omitted factors or from the forward-looking time variation in the quality of loans for each bank, beyond the variation previously accounted for by including a measure of GDP growth and NPLs respectively. To this end, we attempt in this section to further alleviate these concerns.

Table 8 shows alternative specifications that control for country-level demand factors and alternative measures for banks' credit quality. In column I, we replace GDP growth with the annual growth (%) of *domestic demand* made available by the OECD.

[21] *Corporate* are loans and leases to corporate and commercial enterprises. *Personal* are loans and leases to individuals, either unsecured or secured by assets other than residential property. *Mortgage* are loans secured by residential property.

This accounts for the direct impact of demand-related omitted factors as it measures final consumption, investment and stock building expenditures by the private and general government sectors in real terms. The results are very similar to the baseline results providing evidence that the inclusion of country*year fixed effects can saturate our analysis from time-varying country omitted factors.

In column II, we add *loans and advances* to banks in the interbank market at the bank-year level. This controls for banks' responses to changes in their loan opportunity set (net supplier) and for changes in the source of funding (net receiver). The coefficients of the variables of interest are again quantitatively and qualitatively similar to our baseline estimation results.

In columns III-V of Table 8, we replace non-performing loans with alternative proxies for loan quality at the bank-year level. In column III, we add *Reserves for Impaired Loans/ Impaired Loans*. The higher this ratio is, the better and the more comfortable one should feel about the capital base. This measure is related to a forward-looking approach. In column IV, we add *Impaired Loans/ Gross Loans*. This is a measure of the ratio of total loans that are impaired or doubtful. The lower this figure is the better the asset quality. In column V, we add *loan-loss provision*s to control directly for credit risk. The resulting estimates reported in columns III-V of Table 8 are again quantitatively similar to our baseline estimation results.

[Please insert Table 8 about here]

4.6 Bank size and risk

In the specifications considered in Table 9, we dig deeper into potential differences in bank size and risk that might influence our estimated impact of market power on the lending-funding growth gap. In columns I and II, we subdivide the sample into *High* and *Low* for bank size above or below the mean, respectively. While the impact of market power is clearly present and significant in each subsample, the non-linearity of this effect fades. This is not surprising given small banks are less likely to have high market power - see, for example, Bikker et al. (2006) and references therein for the predominantly positive relationship between bank size and market power. Given that we found a parabolic relationship between market power and the lending-funding growth gap, and that the turning point has been estimated to be rather high (with the impact of market power reversing only for superpower banks, less than 5 per cent of our sample), subdividing the sample implies we are left with the decreasing part of the parabola in the small-size subsample, yielding the insignificant quadratic term in column II in Table 9. As for the high-size subsample, which contains both the truncated decreasing part and the increasing "superpower" part, the non-linearity is still detectable albeit both coefficients now have lower significance as can be seen in column I of Table 9. We note that in our baseline estimates we had included bank size as a control variable, thus the effects of market power reported earlier were *net* of the bank size effect. The subsample analysis in columns I and II in Table 9 confirms that size indeed matters, yet the *net* market power effect in our earlier estimates is of greater relevance.

In columns III-V of Table 9, we include both a measure of size and a direct measure of risk in addition to NPLs and to our measure of market power that in part capture risk in our pre-existing specifications. We follow Beck et al. (2013) and Laeven and Levine (2009) among others and use the natural logarithm of the *Z-score* as a measure of banks' risk. The *Z-score* measures the distance from insolvency and is calculated as:

$$Z - score_{i,t} = \frac{ROA_{i,t} + (E/A)_{i,t}}{\sigma(ROA)_{i,t}},$$

where ROA is the return on assets of bank i at time t, E/A denotes the equity to asset ratio and $\sigma(ROA)$ is the standard deviation of return on assets. We use a three-year rolling time window (column III) to compute the standard deviation of ROA to allow for time variation in the denominator of the Z-score. Similarly, we calculate the standard deviation of return on assets with a four-years (column IV) and five-years rolling time window (column V) for robustness. A higher Z-score implies a more sound bank with a lower probability of default. We find that our main results regarding market power remain qualitatively robust when including a direct measure of risk as an explanatory variable.

[Please insert Table 9 about here]

4.7 Banking Crises

Next, we consider a banking crisis variable that serves to proxy for the presence of credit constraints and episodes of low confidence from depositors. Acknowledging what is now widely accepted among macroeconomists and policy-makers alike, i.e., that banking crises are endogenous to prior excessive credit expansion in the banking system, we still find it useful to examine the relationship between banking crises and lending for two main reasons. First, the potentially shock-smoothing behavior of banks is especially critical for current and future welfare during extreme adverse events such us banking crises. Second, while banking crises can be endogenous to past (prior-to-crisis) lending behavior of banks, it is unlikely that the occurrence of banking crises is due to future (or even contemporaneous) lending behavior of any one bank. In our application, we take two annual lags of the banking crisis variable in order to alleviate potential endogeneity of our crisis measure arising due to the effect of past lending on it. Our banking crises measure comes from Laeven and Valencia (2018) who construct a dummy variable that equals one when a country suffers from a banking crisis.

Viewing crises as potential shocks to an individual bank's lending ability, we include an interaction of the banking crisis proxy with the bank-specific Lerner index to help us understand how the impact of market power on $l_t - d_t$ differs between normal and crisis periods. We present results from this estimation exercise in Table 10.

Our main hypothesis in this paper has been that individual banks respond differently to deposit shocks, depending on their degree of market power. Indeed, this appears to be the case during banking crises, yet in a manner that differs from normal periods. In all specifications in Table 10, interacting the linear and the quadratic Lerner index terms with the crisis dummy inverts thus counteracts the respective average effects (see terms without interaction for which the size and sign of coefficients are consistent with the baseline estimates of Table 4). The resulting non-linear relationship during crises thus differs from that in non-crisis times. The overall effect of market power on net lending is negative for most banks during crises and "superpower" banks are no exception in this case as the negative coefficient for the resulting quadratic terms in crisis periods implies a downward sloping parabolic relationship for high values of the Lerner index. This is in sharp contrast to non-crisis periods when market power works differently for superpower banks than for the rest, enabling them to outperform banks in the mid-range of the Lerner index in smoothing the impact of deposit outflows on lending.[22]

We also note that the impact of market power is again greater during periods of deposit decline as compared to periods of increasing deposits, as can be seen in rows (2) to (5) of Table 10 by comparing columns IV-VI respectively to columns VII-IX in each case. Nevertheless, this difference becomes less pronounced during banking crises, even though [some] banks may still enjoy an inflow of deposits then. This underscores that while under normal economic conditions market power matters for banks' ability (and

[22]Arguably, crises may serve to remove any advantages of "superpower" banks as they are systemic events affecting the whole market. More specifically, the advantages of superpower discussed previously were access to funding and the ability to find good quality borrowers. The first advantage is most probably there - "superpower" banks can find extra capital when needed. However, on the lending side, they face the same problem as other banks in the country: the economy in downturn, high risks and interest rates reflecting this high systemic risk, and no credit-worthy lenders willing to borrow at these high rates. At the same time, "superpower" banks are not willing to reduce rates as risks are high, hence no advantage of superpower, while in normal times they were able to offer better rates and attract more borrowers.

willingness) to suppress the impact of deposit outflows on lending, crises hit them all equally, apart from, perhaps, the least powerful banks.

[Please insert Table 10 about here]

4.8 Country-level indicators for the institutional environment

One set of country traits that can influence the competition-funding gap relationship is the institutional framework in the country within which banks operate. The institutional framework may affect the scope for adverse selection and moral hazard by banks, which is one of the crucial ingredients in the model of the lending-funding growth gap. First, we consider an indicator for *legal rights* developed by Kauffmann et al. (2010) (World Bank), which captures the extent to which agents have confidence in and abide by the rules of society. These include perceptions of the effectiveness and predictability of the judiciary and the enforceability of contracts. The index ranges between two and nineteen across the countries in our sample, with higher values suggesting higher legal rights protection. Banks operating in countries with weak legal rights may, for example, find it difficult to expand their loan portfolios to take on additional risks.

A second group of potentially relevant country traits in the context of our empirical exercise concerns *creditor rights.* González (2016) provides evidence that protection of creditor rights has a positive impact on bank charter value and prevents risk-seeking behavior if charters are eroded. As higher protection of rights may influence the relation between market power and the funding gap, we control for creditor rights. We use an index introduced by Djankov et al. (2007) that ranges from 0 (weak creditor rights) to four (strong creditor rights) and is constructed annually from 1992 to 2015.[23]

[23] In Djankov et al. (2007) a score of one is assigned when each of the following rights of secured lenders are defined in laws and regulations: First, there are restrictions such as creditor consent or minimum dividends, for a debtor to file for reorganization. Second, secured creditors can seize their collateral after the reorganization petition is approved, i.e. there is no "automatic stay" or "asset freeze." Third,

The results in column I of Table 11 show a positive and significant coefficient for the interaction of *legal rights* and the *Lerner index*, indicating that legal rights diminish the negative impact of the Lerner index. Moreover, the coefficient is negative and significant for the interaction of *legal rights* with the *squared Lerner index*. Considering the interaction of *creditor rights* with the *Lerner index* in column II of Table 11, we observe qualitatively similar results, but stronger and more strongly significant, to those in column I. The results suggest that good protection of legal and especially creditor rights can turn the impact of market power on the lending-funding growth gap positive, and that these could be used as complements to promote loan growth at the country level.

[Please insert Table 11 about here]

4.9 Further Robustness

In Table 12, we further subject our findings to a battery of robustness tests. All specifications shown utilize the same set of control variables as used in our baseline specifications in Table 4, considering now either alternative estimation techniques or alternative measures of market power.

A possible remaining identification issue might be the dynamic nature of the lending-funding growth gap. To account for these dynamics, we include the first lag of the dependent variable among the regressors and use the GMM estimators for dynamic panels from Arellano and Bond (1991). In our analysis, we use the two-step difference GMM estimator with robust standard errors corrected using the method of Windmeijer (2005). The Hansen test of over-identifying restrictions suggests the validity and strength

secured creditors are paid first out of the proceeds of liquidating a bankrupt firm as opposed to other creditors such as government or workers. Finally, management does not retain the administration of its property pending the resolution of the reorganization.

of our instruments. In column I, we show the results which are qualitatively similar to the baseline estimates.

In columns II and III we use the subcomponents of market power (average price of bank activities and marginal cost, respectively) in place of the Lerner index. In column IV we use the Lerner index with deposits and short term funding, in column V we use the Lerner index with financial capital, in column VI the Lerner index with financial capital including country fixed effects when estimating the marginal cost, in column VII the Lerner index obtained from the dual-output cost function, in column VIII the adjusted Lerner index, and in column IX the Boone indicator.[24] In all cases, the impact of market power for the average bank is estimated to be negative and significant. Furthermore, the non-linear term of market power is estimated to be positive and significant except in column VI where it comes in as marginally insignificant.

[Please insert Table 12 about here]

5 Discussion

All companies, not only financial ones, face variations in the availability of external finance. The main contribution of our paper is in analyzing the role market power plays for a company's ability to cope with these variations. In our study, the "company" is a bank, i.e. a financial intermediary, for which we focus on its lending-funding growth

[24]Koetter et al. (2012) have argued that the conventional approach of computing the Lerner index assumes both profit efficiency (optimal choice of prices) and cost efficiency (optimal choice of inputs by firms). As a result, the estimated price-cost margins do not correctly measure the true extent of market power. The argument reflects a distinction pointed out by Lerner (1934b) himself, who states that "for practical purposes we must read monopoly power not as potential monopoly, but as monopoly in force". To that end, Koetter et al. (2012) propose an adjustment that results in the efficiency-adjusted Lerner index:

$$Adjusted\ Lerner_i = \frac{\pi_i + tc_i - mc_i q_i}{\phi_i + tc_i}$$

where π is the profit of bank i at time t, tc is total cost, mc is marginal cost and q is total output. Like the standard Lerner index, the adjusted Lerner ranges from zero to one, with larger values indicating greater market power.

gap. On the one hand, our results have implications for the choice of external finance by non-financial corporations: to reduce the funding risk enterprises should either choose highly competitive banks or work with those few that are extremely powerful. This is of relevance as external finance is known to affect corporate investment and productivity (Duchin et al., 2010; Butler and Cornaggia, 2011; Levine and Warusawitharana, 2014), and thus firms would benefit from stable and reliable sources of finance.

On the other hand, our approach is directly applicable to non-financial corporations themselves. Based on the above-cited literature on the relation between external finance and corporate productivity, we may wish to focus on the production-funding growth gap. Denote Y_t the company's output and assume it depends on the stock of externally sourced capital B_t and internal capital K_t, with the relationship given by the standard production function $Y_t = A_t \cdot (K_t + B_t)^\beta$, where A_t is the productivity parameter and β is the elasticity of output to the overall capital. The similarity with our equation (3) that determines the amount of loans on the balance sheet of the bank is obvious, apart from the exponent β, which does not allow one to straightforwardly proceed to equation (4) in discrete time. In continuous time, however, taking logs and differentiating the production function equation, and subtracting the growth rate of external finance denoted by b_t from both sides, produces

$$y_t - b_t = a_t + \beta \cdot \frac{K_t}{B_t + K_t} \cdot (k_t - b_t) - (1 - \beta) \cdot b_t. \tag{7}$$

Equation (7) is analogous to our equation (4) that gives rise to the analysis of the two channels that explain the impact of market power on the lending-funding gap. The left-hand side of (7) is the production-funding growth gap, and the right-hand side consists of the productivity change a_t (which corresponds to portfolio rebalancing in the case of a bank), and the substitution of external resources with internal capital (which corresponds to recapitalization in the financial intermediary case).[25] The remainder of our analysis is then, in general terms, about the impact of market power on these two channels, and through them on the ability of corporations to maintain capital-intensive production unchanged or increased in times of severe distress to external funding. Direct availability of data on financial intermediaries and less restrictive assumptions required to construct our base equation (3) make the analysis of financial intermediaries somewhat more straightforward than that of non-financial corporations. However, if the relationships we have uncovered in this paper hold universally, we would also expect competitive companies and those with high market power to be able to more flexibly adjust to a changing financial environment. With this new insight from the banking sector, more research into the potential relationship between market power, external finance and corporate performance is desired. To date, we do not know much about this relationship in corporate finance in general (where Ovtchinnikov (2010) is a rare exception studying the link between competition and firms' financial decisions, but not productivity) and for the financial industry in particular (Berger et al. (2019) is an exception studying the effects of competition on capital management in banks, but not on lending).

With a focus on corporate-banking relationships, our results complement the empirical literature on relationship lending reviewed in Sette and Gobbi (2015), where higher competition dampens the smoothing effect of relationship lending. Our findings suggest that when accounting for overall lending rather than just one component of it, i.e., relationship lending, more competition may actually enhance the smoothing capacity of the banking sector via an increase in the overall lending during periods of falling deposits.

[25]Note that the third term on the right-hand side, $(1-\beta)\cdot b_t$, indicates that the overall impact of the variation in external funding depends on the elasticity of production to capital; moreover, in comparison to (4), we do not have the overall growth term in (7) as we now operate with derivatives, i.e. marginal changes in continuous time.

Focusing more specifically on the smoothing capacity of banks, our findings provide a challenge to the theoretical literature that suggested an inverse relationship between the degree of competition and banks' smoothing ability (e.g. Allen and Gale (1997)). Our results imply a more complex non-linear and asymmetric (over the cycle) relationship between smoothing ability and the degree of competition, with more competitive banks possessing higher smoothing ability than banks with higher market power during periods of falling deposits while, at the same time, a few super-power banks are characterized by higher smoothing ability than banks with some market power during such downturns. During periods of rising deposits, however, higher market power for the average bank enhances smoothing and thus serves to limit amplification and the accumulation of risk in the economy, consistent with Allen and Gale (1997).

Last but not least, in relation to the literature emphasizing the role banks may play in accumulating risk in the economic system, our results imply that certain bank characteristics such as higher market power, may serve to induce more prudent lending practices that help limit the build-up of risk in the banking system during periods of rising deposits.

6 Conclusion

Variation across the degree of competition faced by individual banks in different environments over time has enabled us to investigate banks' smoothing ability and accumulation of risk during periods of falling or rising deposits in relation to their market power. Our answer to the questions posed in the introduction as to which banks tend to smooth/amplify shocks or reduce/accumulate risk and when, is contingent on the overall economic conditions.

Using activity restrictions at the country-year level to obtain exogenous variation in market power, we have shown that for most banks market power has a negative impact on the lending-funding growth gap, implying that more competition for these banks may help smooth adverse shocks to deposits and will tend to amplify positive shocks to deposits. Since more competitive banks are more likely to have a positive lending-funding growth gap, they will also contribute to the build-up of risk in the banking system during periods of rising deposits. That is, more competitive banks along with "superpower" banks, are more likely to smooth shocks during economic downturns associated with falling deposits, but at the cost of amplification and risk accumulation during periods of rising deposits. By contrast, banks with higher market power (but not "superpower") are more likely than other banks to smooth shocks and reduce the build-up of risk during booms associated with rising deposits, but at the cost of amplification of adverse effects during periods of falling deposits.

The asymmetric (stronger) effect of market power we find for periods of deposit decline as compared to periods of deposit growth implies, however, that for the average bank, the smoothing role of competition when deposits are falling is quantitatively more important than the problematic positive impact of competition on amplification and risk accumulation when deposits are growing. Similarly, since in episodes of deposit outflow there is also a starker contrast between the impact of market power for "superpower" banks versus the average bank, the presence of "superpower" banks in the economy will matter more for smoothing in periods of falling deposits than for amplification and the build-up of risk in periods of rising deposits.

In addition, the asymmetry in the market power effect is informative about the role played by the "borrowing/recapitalization" versus "portfolio rebalancing" channels. If portfolio rebalancing had been the only active channel, we would see a more symmetric response of the lending-funding growth gap to changes in market power than we actually observe in the data. Instead, the asymmetry we find suggests that the "borrowing/recapitalization" channel is also active. Interestingly, the size effects (traditionally associated with economies of scale in banking) are observable through the portfolio rebalancing channel rather than through the borrowing/recapitalization one. This dichotomy stresses that the market power effects we observe, go well beyond, and work differently, from any effects attributable to the size of financial institutions.

Based on the above-described results, future research would be well advised to investigate further the role market power plays for the ability of corporations, not only financial, to respond to fluctuations in external funding, and to focus on building macroeconomic models that incorporate a heterogeneous financial sector in order to provide a more complete understanding of the link that exists between individual banks' characteristics, smoothing or amplification of shocks, and the accumulation of risk in the economy. In particular, such models should be able to match asymmetric effects such as the ones uncovered here, and the novel finding regarding the potentially enhancing role of competition for banks' smoothing ability during downturns.

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Tables

Table 1: Definitions and sources of main variables

Name	Description	Data source
	Panel A: Variables used in the derivation of market power	
Earning assets	Natural logarithm of deflated total earning assets.	Bankscope
Price of output	Total income divided by total earning assets.	Bankscope
Expenses	Natural logarithm of deflated total interest expenses and total non-interest expenses.	Bankscope
Price of deposits	Natural logarithm of total interest expenses divided by total customer deposits.	Bankscope
Price of borrowed funds	Natural logarithm of total interest expenses divided by short-term funding.	Bankscope
Price of labor	Natural logarithm of personnel expenses divided by total assets.	Bankscope
Price of physical capital	Natural logarithm of overheads minus personnel expenses divided by fixed assets.	Bankscope
Price of financial capital	Natural logarithm of equity divided by total assets	Bankscope
	Panel B: Variables used in the analysis of market power	
Lending-funding growth gap	The difference between total loan growth and deposits growth.	Bankscope
Corporate loans funding gap	The difference between corporate loans growth and deposits growth.	Bankscope
Personal loans funding gap	The difference between personal loans growth and deposits growth.	Bankscope
Mortgage loans funding gap	The difference between mortgage loans growth and deposits growth.	Bankscope
Loan growth	The annual forward change in the volume of total bank loans between *t+1* to *t*.	Bankscope
Deposits growth	The annual forward change in the volume of total bank deposits between *t+1* to *t*.	Bankscope
Non-performing loans	The ratio of non-performing loans to total loans per bank and year.	Bankscope
Loan-loss provisions	Loan-loss provisions divided by total loans.	Bankscope
Lerner index	The ability of an individual bank to charge a price above marginal cost.	Own calculations
Dual-output Lerner	Variant of the Lerner index that adopts a dual-output cost function.	Own calculations
Adjusted Lerner	Variant of the Lerner index which allows for the possibility that firms do not choose the prices and input levels in a profit-maximizing way.	Own calculations
Boone indicator	The elasticity of profits to marginal costs.	Own calculations
CR5	The five-bank concentration ratio.	Own calculation
ROA	The ratio of net income to total assets.	Own calculation
Equity	Natural logarithm of bank's equity.	Bankscope
Bank size	Natural logarithm of total assets.	Bankscope
OBSI size	Natural logarithm of the off-balance sheet items.	Bankscope
Big bank	A dummy variable equal to one when a bank belong to top-10 pc per country year	Own calculation
GDP growth	Real GDP growth (annual %).	World Development Indicators

Z-score (3 years)	The natural logarithm of the Z-score measures the distance from insolvency and is calculated as $Z_{i,t} = \frac{ROA_{i,t}+(E/A)_{i,t}}{\sigma(ROA_{i,t})}$, where ROA is return on assets of bank i at time t, E/A denotes the equity to asset ratio and $\sigma(ROA)$ is the standard deviation of return on assets with a three-years rolling time window. Similarly, for Z-score (4 years) and Z-score (5 years) we calculate the standard deviation of return on assets with a four-years or five-years rolling time window, respectively. A higher Z-score implies a lower probability of insolvency.	Owns Calculations
Banking crisis	A dummy variable equal to one when a country suffers from a banking crisis with a two years clear window (t,t+1).	Laeven and Valencia (2018)
Legal rights	Legal rights includes indicators which measure the extent to which agents have confidence in and abide by the rules of society. These include perceptions of the effectiveness and predictability of the judiciary, and the enforceability of contracts.	Kauffmann et al. (2010)
Creditor rights	An index aggregating creditor rights following Djankov et al. (2007). The index ranges from 0 (weak creditor rights) to 4 (strong creditor rights) and is constructed as at January for every year from 1992 to 2015.	Djankov et al. (2007)
Domestic demand	Domestic demand is the annual growth (%) of final consumption, investment and stock building expenditures by the private and general government sectors in real terms.	OECD
Loan & advances to banks	Interest-earning balances with central banks and loans and advances to banks net of impairment value including loans pledged to banks as collateral.	Bankscope
Reserves for impaired loans/Gross loans	This ratio relates impairment reserves to non performing or impaired loans. The higher this ratio is, the better and the more comfortable one should feel about the vulnerability of the capital base.	Bankscope
Impaired loans/Gross loans	This is a measure of the ratio of total loans which are impaired. The lower this figure is the better the asset quality is.	Bankscope
	Panel C: Instrumental variables used in the analysis of market power	
Activity restrictions	The score for this variable is determined on the basis of the level of regulatory restrictions on bank participation in: (i) securities activities, (ii) insurance activities, (iii) real estate activities, and (iv) bank ownership of non-financial firms. These activities can be unrestricted, permitted, restricted or prohibited and is assigned the values of 1, 2, 3 or 4, respectively. The index ranges from 0 to 16, with larger values denoting more stringent restrictions.	Barth et al. (2013)
Supervisory power	Index of the powers of the supervisor of the banking sector, reflecting whether the supervisory agency has the authority to take specific actions to prevent and correct problems in the banking sector. Takes values ranges from 0 to 16, with higher values reflecting more supervisory power.	Barth et al. (2013)

Table 2: Summary statistics

Variables	Level	Obs.	Mean	Std. Dev.	Min.	Max.
Panel A: Variables used in the derivation of market power						
Earning assets	Bank	59,397	12.276	2.158	6.839	21.38
Price of output	Bank	59,397	0.085	0.08	0.005	4.257
Expenses	Bank	59,397	9.311	2.058	4.561	18.414
Price of deposits	Bank	59,397	-3.715	1.213	-8.835	3.833
Price of borrowed funds	Bank	59,397	-3.875	1.094	-8.835	0.741
Price of labour	Bank	59,397	-4.343	0.552	-7.541	-1.28
Price of physical capital	Bank	59,397	-0.083	0.928	-2.063	8.934
Price of financial capital	Bank	59,397	-2.396	0.507	-8.396	-0.047
Panel B: Variables used in the analysis of market power						
Lending-funding growth gap	Bank	59,397	0.474	18.925	-99.892	99.99
Corporate loans funding gap	Bank	18,511	0.274	21.067	-95.892	97.506
Personal loans funding gap	Bank	18,625	0.115	19.470	-94.892	99.769
Mortgage loans funding gap	Bank	18,534	0.088	19.473	-93.892	94.769
Loan growth	Bank	58,801	8.651	19.757	-99.764	100
Deposits growth	Bank	58,792	8.22	19.927	-100	100
Non-performing loans (%)	Bank	59,397	4.187	6.65	0	100
Loan-loss provision (%)	Bank	54,081	0.518	0.986	0	47.38
Lerner index	Bank	59,397	0.25	0.114	-0.199	0.924
Lerner index with deposits	Bank	59,397	0.25	0.114	-0.2	0.924
Lerner index with financial capital	Bank	59,393	0.252	0.114	-0.199	0.926
Lerner index with country FE	Bank	59,391	0.236	0.115	-0.229	0.915
Dual-output Lerner index	Bank	56,048	0.25	0.112	-0.2	0.92
Adjusted Lerner	Bank	57,761	0.205	0.119	-0.200	0.919
Boone Indicator	Bank	59,397	-0.251	0.188	-0.901	0.039
CR5	Country	49,889	0.477	0.273	0.032	1
ROA	Bank	59,397	0.012	0.015	-0.46	0.326
Equity	Bank	59,397	10.689	1.763	5.075	19.148
Bank size	Bank	59,397	13.084	1.833	7.786	21.744
OBSI size	Bank	54,463	9.746	2.689	-1.583	21.466
Big Bank	Bank	59,397	0.501	0.219	0	1
GDP growth	Country	59,392	2.391	3.117	-14.814	34.5
Z-score (3 years)	Bank	59,290	3.694	1.196	-17.239	14.737
Z-score (4 years)	Bank	59,293	3.611	1.185	-17.239	14.737
Z-score (5 years)	Bank	59,296	3.559	1.183	-17.239	14.737
Banking crisis	Country	59,397	0.045	0.207	0.000	1.000
Legal rights	Country	51,997	11.793	2.720	2.000	19.000
Creditor rights	Country	58,634	1.583	0.821	0.000	4.000
Domestic demand	Country	47,170	1.926	2.933	-23.309	18.279
Loans & advances to banks	Bank	502	8.562	2.995	0.000	17.231
Reserves for impaired loans/Gross loans	Bank	24,749	3.581	4.618	-0.480	95.240
Impaired loans/Gross loans	Bank	24,341	5.857	7.523	0.000	100.000
Panel C: Instrumental variables used in the analysis of market power						
Activity restrictions	Country	49,646	10.136	3.003	0	16
Supervisory power	Country	48,301	12.074	2.229	4	16

The table reports summary statistics for the variables used in the empirical analysis. The variables are defined in Table 1.

Table 3: The impact of non-performing loans and market power on the lending-funding growth gap

	Full sample			Deposits DOWN			Deposits UP		
	I	II	III	IV	V	VI	VII	VIII	IX
Non-performing loans (%)	-0.166***	-0.300***	-0.155***	-0.211***	-0.307***	-0.178***	-0.130***	-0.261***	-0.129***
	[-11.560]	[-11.186]	[-4.906]	[-9.252]	[-5.863]	[-3.253]	[-6.982]	[-7.868]	[-3.068]
Lerner index	-2.408***	-3.691***	-8.280***	-2.243*	-6.075***	-6.765***	-3.138***	-4.276**	-8.856***
	[-2.848]	[-2.613]	[-5.609]	[-1.708]	[-2.579]	[-2.820]	[-2.841]	[-2.236]	[-4.395]
Observations	59,398	58,654	57,505	23,622	22,042	21,157	35,776	34,416	33,283
R-squared	0.027	0.171	0.255	0.036	0.258	0.323	0.027	0.244	0.348
Chow test (P-value)							0.000	0.000	0.000
$H_0 : \widehat{\beta}^{Deposit\ Down} = \widehat{\beta}^{Deposit\ UP}$									
Year FE	Y	Y	N	Y	Y	N	Y	Y	N
Bank FE	N	Y	Y	N	Y	Y	N	Y	Y
Country*Year*Specialization FE	N	N	Y	N	N	Y	N	N	Y
Clustered standard errors	Country	Country	Country	Country	Country	Country	Country	Country	Country

The table reports coefficients and t-statistics (in brackets) of regressions investigating the impact of non-performing loans and market power on the lending-funding growth gap. We estimate the regression $[GL_{i,j,t+1} - GD_{i,j,t+1}] = \alpha_f + MP_{i,j,t} + NPL_{i,j,t-1} + \varepsilon_{i,j,t}$, where i is an index specific to the bank; j is an index specific to country; and t is an index for years. $MP_{i,j,t}$, measures the Lerner index and $NPL_{i,j,t-1}$, measures non-performing loans. All variables are defined in Table 1. In columns IV-VI and VII-IX we restrict our analysis only to periods with declining deposits (< 0) and rising deposits (> 0), respectively. To test for differences in coefficients across subgroups we use the Chow test. All regressions are estimated with High Dimensional Fixed Effects (HDFE) and include fixed effects as noted in the lower part of the table to control for different levels of unobserved heterogeneity. Standard errors are robust and clustered at the country level. The *,**,*** marks denote the statistical significance at the 10, 5, and % level, respectively.

Table 4: Baseline results

	Full sample			Deposits DOWN			Deposits UP		
	I	II	III	IV	V	VI	VII	VIII	IX
Non-performing loans (%)	-0.236***	-0.140**	-0.146**	-0.234***	-0.214**	-0.174*	-0.213***	-0.092**	-0.077
	[-5.616]	[-2.597]	[-2.523]	[-3.026]	[-2.307]	[-1.679]	[-4.999]	[-2.038]	[-1.468]
Lerner index	-14.932***	-12.941***	-14.119***	-25.248***	-19.402***	-18.445***	-11.041**	-10.021**	-12.009***
	[-3.115]	[-2.904]	[-3.573]	[-4.079]	[-3.875]	[-3.649]	[-2.189]	[-2.129]	[-2.962]
Lerner index squared	16.133**	15.540***	16.741***	34.063***	26.680***	24.812***	15.277**	15.067**	17.629***
	[2.578]	[2.804]	[3.195]	[2.918]	[3.144]	[3.068]	[2.330]	[2.580]	[2.712]
CR5	-4.248			-4.264			-3.330		
	[-1.166]			[-0.697]			[-0.998]		
ROA	45.007***	6.169	6.572	50.569**	-2.246	5.392	11.376	-19.210	-14.812
	[2.998]	[0.299]	[0.318]	[2.257]	[-0.102]	[0.257]	[0.490]	[-0.613]	[-0.451]
Equity	-4.573***	-5.032***	-5.286***	-3.046**	-2.316*	-2.515**	-5.115***	-5.650***	-5.721***
	[-5.113]	[-5.593]	[-5.360]	[-1.988]	[-1.915]	[-2.081]	[-5.843]	[-5.985]	[-5.509]
Bank size	4.681***	5.360***	5.443***	2.084	1.838	1.922	5.389***	6.054***	5.979***
	[3.836]	[4.748]	[4.877]	[1.141]	[1.406]	[1.512]	[4.825]	[5.505]	[5.651]
OBSI	-0.023	-0.166	-0.145	0.034	-0.302*	-0.243	-0.054	-0.135	-0.150
	[-0.179]	[-1.607]	[-1.248]	[0.171]	[-1.905]	[-1.464]	[-0.313]	[-0.900]	[-1.000]
GDP growth	0.523***			0.487**			0.424***		
	[5.258]			[2.025]			[3.968]		
Observations	44,710	44,351	43,626	16,235	15,734	15,383	26,496	26,058	25,418
R-squared	0.181	0.261	0.273	0.298	0.356	0.357	0.244	0.350	0.366
Turning point (Lerner index)	0.463	0.416	0.422	0.371	0.364	0.372	0.361	0.332	0.341
Joint significance (Lerner index)	0.001	0.010	0.001	0.000	0.001	0.002	0.050	0.029	0.003
Marginal effect at mean ($\frac{\partial y}{\partial (Lerner\ index)}$)	-2.029	-2.016	-2.221	-3.287	-2.913	-2.739	-1.484	-1.620	-1.875
Chow test (P-value) $H_0 : \widehat{\beta}^{Deposit\ Down} = \widehat{\beta}^{Deposit\ UP}$							0.000	0.000	0.000
Year FE	Y	N	N	Y	N	N	Y	N	N
Bank FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country*Year FE	N	Y	N	N	Y	N	N	Y	N
Country*Year*Specialization FE	N	N	Y	N	N	Y	N	N	Y
Clustered standard errors	Country	Country	Country	Country	Country	Country	Country	Country	Country

The table reports coefficients and t-statistics (in brackets) of regressions investigating the impact of non-performing loans and market power on the lending-funding growth gap. We estimate the regression $[GL_{i,j,t+1} - GD_{i,j,t+1}] = \alpha_f + MP_{i,j,t} + MP^2_{i,j,t} + NPL_{i,j,t-1} + X_{i,j,t} + Z_{j,t} + \varepsilon_{i,j,t}$, where i is an index specific to the bank; j is an index specific to country; and t is an index for years. $MP_{i,j,t}$, measures the Lerner index, $MP^2_{i,j,t}$, measures the Lerner index squared and $NPL_{i,j,t-1}$, measures non-performing loans. All variables are defined in Table 1. In columns IV-VI and VII-IX we restrict our analysis only to periods with declining deposits (< 0) and rising deposits (> 0), respectively. To test for differences in coefficients across subgroups we use the Chow test. All regressions are estimated with High Dimensional Fixed Effects (HDFE) and include fixed effects as noted in the lower part of the table to control for different levels of unobserved heterogeneity. Standard errors are robust and clustered at the country level. The *,**,*** marks denote the statistical significance at the 10, 5, and % level, respectively.

Table 5: Results from 2SLS model

	Full sample	Deposits DOWN	Deposits UP
	I	II	III
	Panel A: First-stage results		
Activity restrictions	0.241***	0.038**	0.266***
	[5.501]	[2.100]	[4.422]
Supervisory power	0.330***	0.112***	0.344***
	[6.731]	[2.471]	[5.211]
R-squared	0.775	0.944	0.813
Year FE	Y	Y	Y
Bank FE	Y	Y	Y
	Panel B: Second-stage results		
$\widehat{\textit{Lerner index}}$	-8.971***	-13.075**	-8.344***
	[-3.843]	[-2.292]	[-3.203]
$\widehat{\textit{Lerner index}}$ *squared*	12.479***	21.273**	10.116**
	[2.929]	[2.262]	[2.341]
Observations	28,935	9,731	17,238
Hansen IV (P-Value)	0.786	0.884	0.705
Chow test (P-value) $H_0 : \widehat{\beta}^{Deposit\ Down} = \widehat{\beta}^{Deposit\ UP}$		0.000	0.000
Turning point (Lerner index)	0.359	0.307	0.412
Join Significance (Lerner index)	0.000	0.000	0.000
Control Variables (Bank-country)	Y	Y	Y
Year FE	Y	Y	Y
Bank FE	Y	Y	Y
Clustered standard errors	Bank-Country	Bank-Country	Bank-Country

The table reports coefficients and t-statistics (in brackets) using a 2SLS regressions. We estimate the regression $[GL_{i,j,t+1} - GD_{i,j,t+1}] = \alpha_f + \widehat{MP_{i,j,t}} + \widehat{MP^2_{i,j,t}} + NPL_{i,j,t-1} + X_{i,j,t} + Z_{j,t} + \varepsilon_{i,j,t}$, where i is an index specific to the bank; j is an index specific to country; and t is an index for years. $MP_{i,j,t}$, measures the Lerner index, $MP^2_{i,j,t}$, measures the Lerner index squared and $NPL_{i,j,t-1}$, measures non-performing loans. The first stage regressions are given in Panel A. *Activity restrictions* and *supervisory power* range from 1999-2012 at the country-year level. All variables are defined in Table 1. In columns II and III, we restrict our analysis only to periods with declining deposits (< 0) and rising deposits (> 0), respectively. To test for differences in coefficients across subgroups we use the Chow test. All regressions are estimated with High Dimensional Fixed Effects (HDFE), include the control variables that are reported in Table 4 and fixed effects as noted in the lower part of the table to control for different levels of unobserved heterogeneity. Standard errors are robust and clustered at the bank-country level. The *,**,*** marks denote the statistical significance at the 10, 5, and % level, respectively.

Table 6: Effects of market structure on deposit growth and loan growth separately

Dependent variable:	Loan growth			Deposits growth		
	I	II	III	IV	V	VI
Non-performing loans (%)	-0.510***	-0.387***	-0.419***	-0.292***	-0.239***	-0.257***
	[-14.381]	[-11.874]	[-12.250]	[-9.248]	[-7.904]	[-8.156]
Lerner index	-25.440***	-19.950***	-19.815***	-9.349***	-7.558**	-6.640*
	[-7.019]	[-6.057]	[-5.916]	[-2.647]	[-2.215]	[-1.897]
Lerner index squared	38.861***	23.638***	23.275***	24.545***	14.075**	12.356*
	[5.945]	[3.806]	[3.685]	[3.682]	[2.097]	[1.785]
Observations	44,303	43,944	43,228	44,319	43,959	43,237
R-squared	0.457	0.637	0.645	0.434	0.609	0.617
Turning point (Lerner index)	0.327	0.422	0.426	0.190	0.268	0.268
Join significance (Lerner index)	0.000	0.000	0.000	0.000	0.081	0.160
Marginal effect at mean ($\frac{\partial y}{\partial(Lerner\ index)}$)	-2.125	-1.895	-1.886	0.088	0.030	0.142
Control Variables (Bank-Country)	Y	Y	Y	Y	Y	Y
Year FE	Y	N	N	Y	N	N
Bank FE	Y	Y	Y	Y	Y	Y
Country*Year FE	N	Y	N	N	Y	N
Country*Year*Specialization FE	N	N	Y	N	N	N
Clustered standard errors	Country	Country	Country	Country	Country	Country

The table reports coefficients and t-statistics (in brackets). We estimate the regression $Y_{i,j,t+1} = \alpha_f + MP_{i,j,t} + MP^2_{i,j,t} + NPL_{i,j,t-1} + X_{i,j,t} + Z_{j,t} + \varepsilon_{i,j,t}$, where i is an index specific to the bank; j is an index specific to country; and t is an index for years. $MP_{i,j,t}$, measures the Lerner index, $MP^2_{i,j,t}$, measures the Lerner index squared and $NPL_{i,j,t-1}$, measures non-performing loans. In columns I-III and IV-VI the dependent variable is loan growth and deposits growth, respectively. All variables are defined in Table 1. All regressions are estimated with High Dimensional Fixed Effects (HDFE), include the control variables that are reported in Table 4 and fixed effects as noted in the lower part of the table to control for different levels of unobserved heterogeneity. Standard errors are robust and clustered at the country level. The *,**,*** marks denote the statistical significance at the 10, 5, and % level, respectively.

Table 7: Effects of maturity mismatch and loan categories on the lending-funding growth gap

	I	II	III	IV	V
	Maturity		Type of loans		
	Deposits>1 year	Loans>1 year	Corporate	Personal	Mortgage
Non-performing loans	-0.141	-0.122**	-0.146*	-0.127**	-0.124**
	[-1.652]	[-2.521]	[-1.736]	[-2.393]	[-2.315]
Lerner index	-16.825*	-19.624**	-17.389**	-19.283**	-18.625**
	[-1.977]	[-2.492]	[-2.076]	[-2.152]	[-2.131]
Lerner index squared	25.750*	32.669**	25.499*	30.259**	30.034**
	[1.676]	[2.105]	[1.728]	[2.101]	[2.159]
Observations	13,125	5,888	13,272	13,147	13,070
R-squared	0.385	0.219	0.370	0.379	0.380
F-stat	5.499	3.083	4.526	4.203	4.036
Turning point (Lerner index)	0.326	0.300	0.340	0.318	0.310
Joint significance (Lerner index)	0.140	0.049	0.100	0.090	0.097
Control Variables (Bank-Country)	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y
Country*Year FE	Y	Y	Y	Y	Y
Clustered standard errors	Country	Country	Country	Country	Country

The table reports coefficients and t-statistics (in brackets). We estimate the regression $[GL_{i,j,t+1} - GD_{i,j,t+1}] = \alpha_f + MP_{i,j,t} + MP^2_{i,j,t} + NPL_{i,j,t-1} + X_{i,j,t} + Z_{j,t} + \varepsilon_{i,j,t}$, where i is an index specific to the bank; j is an index specific to country; and t is an index for years. $MP_{i,j,t}$, measures the Lerner index, $MP^2_{i,j,t}$, measures the Lerner index squared and $NPL_{i,j,t-1}$, measures non-performing loans. All variables are defined in Table 1. In columns I and II, we restrict our sample to banks that report deposits with maturity longer than 1 year and to those that report loans with maturity longer than 1 year, respectively. In columns III-V, the dependent variable is respectively the corporate, personal or mortgage lending-funding growth gap. All regressions are estimated with High Dimensional Fixed Effects (HDFE), include the control variables that are reported in Table 4 and fixed effects as noted in the lower part of the table to control for different levels of unobserved heterogeneity. Standard errors are robust and clustered at the country level. The *,**,*** marks denote the statistical significance at the 10, 5, and % level, respectively.

Table 8: Effects of domestic demand and loan quality on the lending-funding growth gap

	I	II	III	IV	V
	Domestic demand	Interbank loans	Forward looking	Relative size	LLP
Non-performing loans	-0.323***	-4.998***			
	[-5.700]	[-38.885]			
Lerner index	-15.745***	-96.561***	-16.573***	-14.208**	-11.131***
	[-3.195]	[-26.390]	[-2.856]	[-2.221]	[-2.846]
Lerner index squared	18.811***	30.929***	25.967***	21.434**	19.567***
	[4.155]	[8.060]	[2.669]	[2.238]	[2.661]
Domestic demand	0.649***				
	[3.904]				
Loans & advances to banks		-2.000***			
		[-140.038]			
Reserves for impaired loans/ Gross loans			-0.239**		
			[-2.006]		
Impaired loans/ Gross Loans				-0.096*	
				[-1.832]	
Loan-loss provisions					-1.406***
					[-10.720]
Observations	36,564	324	20,472	17,999	38,009
R-squared	0.181	0.246	0.347	0.352	0.280
F-stat	37.62		8.277	8.235	28.78
Turning point (Lerner index)	0.418	1.560	0.032	0.331	0.284
Joint significance (Lerner index)	0.000	0.000	0.018	0.080	0.000
Control Variables (Bank-Country)	Y	Y	Y	Y	Y
Year FE	Y	N	N	N	N
Country FE	Y	N	N	N	N
Bank FE	Y	Y	Y	Y	Y
Country*Year FE	N	Y	Y	Y	Y
Clustered standard errors	Country	Country	Country	Country	Country

The table reports coefficients and t-statistics (in brackets). We estimate the regression $[GL_{i,j,t+1} - GD_{i,j,t+1}] = \alpha_f + MP_{i,j,t} + MP^2_{i,j,t} + NPL_{i,j,t-1} + X_{i,j,t} + Z_{j,t} + \varepsilon_{i,j,t}$, where i is an index specific to the bank; j is an index specific to country; and t is an index for years. $MP_{i,j,t}$, measures the Lerner index, $MP^2_{i,j,t}$, measures the Lerner index squared and $NPL_{i,j,t-1}$, measures non-performing loans. All variables are defined in Table 1. All regressions are estimated with High Dimensional Fixed Effects (HDFE), include the control variables that are reported in Table 4 and fixed effects as noted in the lower part of the table to control for different levels of unobserved heterogeneity. Standard errors are robust and clustered at the country level. The *,**,*** marks denote the statistical significance at the 10, 5, and % level, respectively.

Table 9: Effects of bank size and risk on the lending-funding growth gap

	I	II	III	IV	V
Categories	Bank size =High	Bank size =Low		Bank risk	
Non-performing loans	-0.142**	-0.145	-0.133**	-0.136**	-0.135**
	[-2.401]	[-1.149]	[-2.308]	[-2.331]	[-2.330]
Lerner index	-13.119**	-15.173***	-15.302***	-15.112***	-15.252***
	[-2.393]	[-3.269]	[-3.773]	[-3.753]	[-3.765]
Lerner index squared	14.569*	9.276	19.998***	19.521***	20.083***
	[1.745]	[1.077]	[3.793]	[3.695]	[3.775]
Z-score (3 years)			0.332***		
			[4.229]		
Z-score (4 years)				0.250***	
				[3.015]	
Z-score (5 years)					0.397***
					[4.210]
Observations	22,179	21,290	43,540	43,542	43,544
R-squared	0.309	0.286	0.272	0.272	0.272
F-stat	10.28	16.40	27.12	22.38	23.14
Turning point (Lerner index)	0.450	0.817	0.382	0.387	0.379
Joint significance (Lerner index)	0.050	0.000	0.000	0.000	0.000
Control Variables (Bank-Country)	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y
Year*Country FE	Y	Y	Y	Y	Y
Clustered standard errors	Country	Country	Country	Country	Country

The table reports coefficients and t-statistics (in brackets). We estimate the regression $[GL_{i,j,t+1} - GD_{i,j,t+1}] = \alpha_f + MP_{i,j,t} + MP^2_{i,j,t} + NPL_{i,j,t-1} + X_{i,j,t} + Z_{j,t} + \varepsilon_{i,j,t}$, where i is an index specific to the bank; j is an index specific to country; and t is an index for years. $MP_{i,j,t}$, measures the Lerner index, $MP^2_{i,j,t}$, measures the Lerner index squared and $NPL_{i,j,t-1}$, measures non-performing loans. All variables are defined in Table 1. In columns I and II we restrict our sample to cases where bank size is above (high) or below (low) the mean, respectively. In columns III-V, we add the z-score with different rolling years to control for the bank risk. All regressions are estimated with High Dimensional Fixed Effects (HDFE), include the control variables that are reported in Table 4 and fixed effects as noted in the lower part of the table to control for different levels of unobserved heterogeneity. Standard errors are robust and clustered at the country level. The *,**,*** marks denote the statistical significance at the 10, 5, and % level, respectively.

Table 10: Effects of banking crises on the lending-funding growth gap

	Full Sample			Deposits DOWN			Deposits UP		
	I	II	III	IV	V	VI	VII	VIII	IX
Non-performing loans	-0.236***	-0.234***	-0.148**	-0.233***	-0.219***	-0.237***	-0.215***	-0.164***	-0.169***
	[-5.726]	[-6.073]	[-2.548]	[-3.049]	[-2.941]	[-3.185]	[-5.066]	[-3.719]	[-3.760]
Lerner index	-17.200***	-17.590***	-16.344***	-29.016***	-29.787***	-30.524***	-12.821**	-11.314**	-12.501***
	[-3.311]	[-3.535]	[-3.816]	[-4.160]	[-4.456]	[-4.750]	[-2.281]	[-2.308]	[-2.657]
Lerner index* Banking crisis	25.590**	26.215**	19.003***	30.579***	34.244***	32.639***	23.340*	22.120*	23.123**
	[2.284]	[2.397]	[3.347]	[2.836]	[2.873]	[2.912]	[1.865]	[1.951]	[2.007]
Lerner index squared	21.383***	21.062***	21.023***	41.659***	41.839***	42.926***	19.568***	24.948***	27.037***
	[3.162]	[3.216]	[3.798]	[3.279]	[3.225]	[3.355]	[2.816]	[3.729]	[3.937]
Lerner index squared * Banking crisis	-61.607**	-64.999**	-46.661***	-62.190***	-70.367***	-68.862***	-61.993	-53.572*	-53.900*
	[-2.383]	[-2.476]	[-3.349]	[-2.766]	[-2.994]	[-2.973]	[-1.618]	[-1.928]	[-1.962]
Banking crisis	-0.653	0.437	-3.310***	-1.961	-2.083	-1.256	-0.161	-5.692***	-5.895***
	[-0.611]	[0.290]	[-2.972]	[-1.304]	[-0.893]	[-0.592]	[-0.131]	[-5.909]	[-6.082]
Observations	44,710	44,710	43,626	16,235	16,235	16,231	26,496	26,496	26,496
R-squared	0.181	0.184	0.273	0.298	0.302	0.311	0.244	0.245	0.252
F-stat	18.35	11.24	23.49	7.149	7.617	10.37	13.77	14.94	15.77
Turning point (Lerner index, Crisis==0)	0.402	0.417	0.388	0.348	0.355	0.355	0.327	0.226	0.231
Turning point (Lerner index, Crisis==1)	0.104	0.098	0.051	0.038	0.078	0.040	0.123	0.188	0.197
Joint significance (Lerner index)	0.000	0.002	0.000	0.000	0.000	0.000	0.021	0.000	0.000
Chow test (P-Value)							0.000	0.000	0.000
Ho:									
Control Variables (Bank-Country)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	N	N	Y	N	N	Y	N	N
Bank FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country*Year FE	N	Y	N	N	Y	N	N	Y	N
Country*Year*Specialization FE	N	N	Y	N	N	Y	N	N	Y
Clustered standard errors	Country	Country	Country	Country	Country	Country	Country	Country	Country

The table reports coefficients and t-statistics (in brackets). We estimate the regression $[GL_{i,j,t+1} - GD_{i,j,t+1}] = \alpha_f + MP_{i,j,t} + MP^2_{i,j,t} + NPL_{i,j,t-1} + X_{i,j,t} + Z_{j,t} + \varepsilon_{i,j,t}$, where i is an index specific to the bank; j is an index specific to country; and t is an index for years. $MP_{i,j,t}$, measures the Lerner index, $MP^2_{i,j,t}$, measures the Lerner index squared and $NPL_{i,j,t-1}$, measures non-performing loans. All variables are defined in Table 1. In columns IV-VI and VII-IX we restrict our analysis to periods with declining deposits (< 0) and rising deposits (> 0), respectively. All regressions are estimated with High Dimensional Fixed Effects (HDFE), include the control variables that are reported in Table 4 and fixed effects as noted in the lower part of the table to control for different levels of unobserved heterogeneity. Standard errors are robust and clustered at the country level. The *,**,*** marks denote the statistical significance at the 10, 5, and % level, respectively.

Table 11: Effects of institutional environment on the lending-funding growth gap

	I	II
Interaction variable:	Legal rights	Creditor Rights
Non-performing loans	-0.096***	-0.146***
	[-2.761]	[-2.633]
Lerner index	-30.119**	-17.193***
	[-2.397]	[-5.543]
Lerner index * Variable	1.965*	17.564***
	[1.731]	[2.628]
Lerner index squared	48.907**	20.798***
	[2.368]	[3.398]
Lerner index squared * Variable	-3.108*	-21.921*
	[-1.700]	[-1.714]
Observations	39,180	43,736
R-squared	0.137	0.258
F-stat	10.23	19.21
Turning point (Lerner index)	0.307	0.413
Joint significance (Lerner index)	0.050	0.000
Control Variables (Bank-Country)	Y	Y
Bank FE	Y	Y
Year*Country FE	Y	Y
Clustered standard errors	Country	Country

The table reports coefficients and t-statistics (in brackets). We estimate the regression $[GL_{i,j,t+1} - GD_{i,j,t+1}] = \alpha_f + MP_{i,j,t} + MP^2_{i,j,t} + NPL_{i,j,t-1} + X_{i,j,t} + Z_{j,t} + \varepsilon_{i,j,t}$, where i is an index specific to the bank; j is an index specific to country; and t is an index for years. $MP_{i,j,t}$, measures the Lerner index, $MP^2_{i,j,t}$, measures the Lerner index squared and $NPL_{i,j,t-1}$, measures the non-performing loans. All variables are defined in Table 1. In column I and II, we interact the Lerner index with the legal rights index and creditor rights, respectively. All regressions are estimated with High Dimensional Fixed Effects (HDFE), include the control variables that are reported in Table 4 and fixed effects as noted in the lower part of the table to control for different levels of unobserved heterogeneity. Standard errors are robust and clustered at the country level. The *,**,*** marks denote the statistical significance at the 10, 5, and % level, respectively.

Table 12: Robustness test

	I	II	III	IV	V	VI	VII	VIII	IX
	GMM	P	MC	Lerner with DSTF	Lerner with financial capital	Lerner with country FE	Dual-output Lerner	Adjusted Lerner	1-Boone indicator
Lagged dependent	-0.024***								
	[-2.981]								
Non-performing loans	-0.615*	-0.129***	-0.136***	-0.140***	-0.133***	-0.133***	-0.140***	-0.108**	-0.150***
	[-1.763]	[-3.659]	[-3.878]	[-3.985]	[-3.789]	[-3.796]	[-3.990]	[-1.988]	[-4.303]
Subcompenent		-26.107***	-18.972**						
		[-3.131]	[-2.267]						
Market power	-45.025***			-12.455***	-11.573***	-11.376***	-12.075***	-11.467**	-72.496***
	[-3.079]			[-3.436]	[-3.172]	[-3.342]	[-3.363]	[-2.179]	[-5.829]
Market power squared	150.476***			16.137**	11.751*	11.107	15.233**	34.336***	19.577***
	[7.188]			[2.321]	[1.687]	[1.594]	[2.149]	[6.109]	[4.599]
Observations	20,303	44,372	44,372	44,372	44,366	44,352	44,372	43,016	44,372
Wald (P-Value)	0.000								
Hansen(overall)	0.808								
R-squared		0.262	0.261	0.261	0.259	0.260	0.261	0.262	0.264
F-stat		16.060	15.230	14.990	6.730	7.110	15.040	21.93	24.510
Turning point (Lerner index)	0.149			0.385	0.492	0.512	0.396	0.166	1.851
Joint significance (Lerner index)	0.000			0.001	0.000	0.000	0.000	0.000	0.000
Control Variables (Bank-Country)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	N	N	N	N	N	N	N	N
Country FE	Y	N	N	N	N	N	N	N	N
Bank FE	N	Y	Y	Y	Y	Y	Y	Y	Y
Country*Year FE	N	Y	Y	Y	Y	Y	Y	Y	Y
Clustered standard errors	Country	Country	Country	Country	Country	Country	Country	Country	Country

The table reports coefficients and t-statistics (in brackets). We estimate the regression $[GL_{i,j,t+1} - GD_{i,j,t+1}] = \alpha_f + MP_{i,j,t} + MP^2_{i,j,t} + NPL_{i,j,t-1} + X_{i,j,t} + Z_{j,t} + \varepsilon_{i,j,t}$, where i is an index specific to the bank; j is an index specific to country; and t is an index for years. All variables are defined in Table 1. Column I shows the baseline results with the two-step difference GMM estimator. Columns II-IX confirm the results of our baseline regression when using alternative measures of market power. In columns II and III we replace market power with its two subcomponents, the average price of bank activities and marginal cost, respectively. In column IV we use the Lerner index with deposits and short term funding, in column V we use the Lerner index with financial capital, in VI the Lerner index with financial capital when we include country fixed effects in the estimation of marginal cost, in VII the Lerner index obtained from the dual-output cost function, in VIII the adjusted Lerner and in IX the Boone indicator. All regressions are estimated with High Dimensional Fixed Effects (HDFE), include the control variables that are reported in Table 4 and fixed effects as noted in the lower part of the table to control for different levels of unobserved heterogeneity. Standard errors are robust and clustered at the country level. The *,**,*** marks denote the statistical significance at the 10, 5, and % level, respectively.

Appendices

A Further details on the lending-funding growth gap

The lending-funding growth gap, $l_t - d_t$ is best understood as a measure of sensitivity, and is closely related to the elasticity of bank lending to a shift in the deposit intake:

$$\frac{\frac{\Delta L_t}{L_t}}{\frac{\Delta D_t}{D_t}} = \frac{l_t}{d_t} \tag{A.1}$$

For example, banks with low constant elasticity of lending to deposit inflow, $\frac{l}{d} = c < 1$ always smooth shocks as for them $l - d = (c-1) \cdot d < 0$ for positive d and $l - d > 0$ for negative d (see Figure A.1), while banks with $\frac{l}{d} = c > 1$ always amplify these as for them $l - d > 0$ for positive d and $l - d < 0$ for negative d (see again Figure A.1). We note that even though the elasticity parameter $\frac{l}{d}$ is not well-defined for values of d close to zero, the linear difference $l - d$ provides a similar insight into the relationship between lending and deposit growth rates without ruling out small deposit growth rates.

If instead of using the lending-funding growth gap, we tried to capture the sensitivity of lending to deposit inflows using the elasticity measure $\frac{l_t}{d_t}$, then $\frac{l_t}{d_t} > 1$ would refer to amplification and $\frac{l_t}{d_t} < 1$ to smoothing, including the case when l_t and d_t are of opposite signs, $\frac{l_t}{d_t} < 0 < 1$.

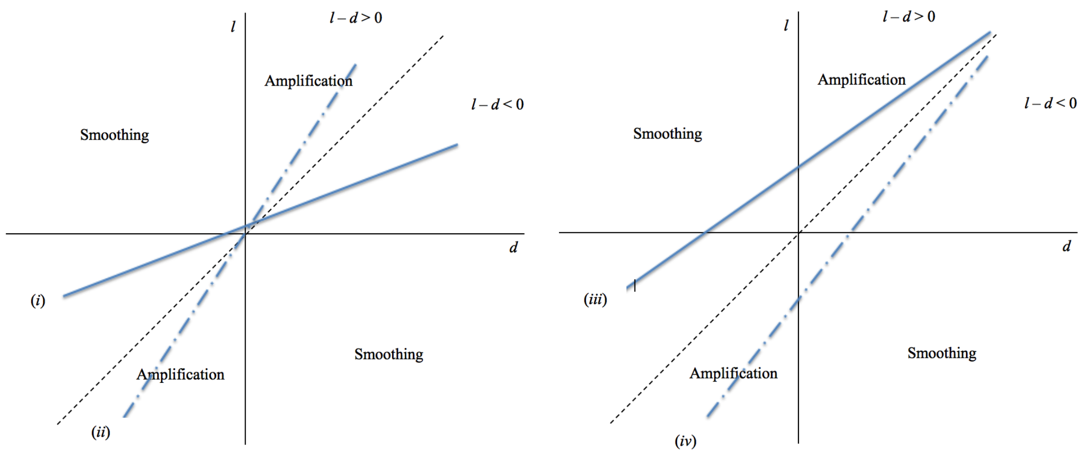
To derive the link between the relative customer funding gap, $\frac{L_t - D_t}{L_t}$, and the lending-funding growth gap, note that a change in the former, $\Delta_t \left(\frac{L-D}{L}\right)$, is given by a change in the deposits-to-loans ratio:

$$\Delta_t \left(\frac{L-D}{L}\right) = \frac{L_{t+1} - D_{t+1}}{L_{t+1}} - \frac{L_t - D_t}{L_t} = \frac{D_t}{L_t} - \frac{D_{t+1}}{L_{t+1}} = -\Delta_t \left(\frac{D}{L}\right). \tag{A.2}$$

A percentage change in the latter is linked to the lending-funding growth gap:

$$-\frac{\Delta_t \left(\frac{D}{L}\right)}{\frac{D_t}{L_t}} = -\frac{L_t}{L_{t+1}} \cdot \frac{L_t D_{t+1} - D_t L_{t+1}}{L_t D_t} = -\frac{L_t}{L_{t+1}} \cdot (d_t - l_t) = \frac{1}{1 + l_t} \cdot (l_t - d_t). \tag{A.3}$$

Figure A.1: Types of banks with regards to smoothing/amplification.



Notes: Type (*i*) banks almost always smooth shocks, type (*ii*) banks always amplify shocks, type (*iii*) banks are more likely to smooth negative shocks and amplify positive ones, while type (*iv*) banks are more likely to amplify negative shocks and smooth positive ones.

We can therefore write

$$\Delta_t \left(\frac{L - D}{L} \right) = \frac{1}{1 + l_t} \cdot (l_t - d_t) \cdot \frac{D_t}{L_t}. \tag{A.4}$$

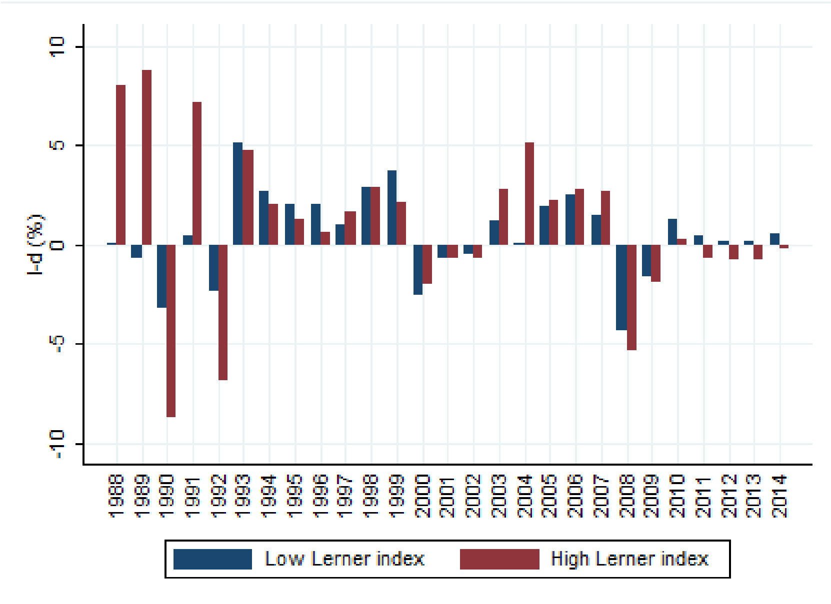
Note that $\frac{1}{1+l_t} \cdot (l_t - d_t)$ in the expression transforms to $1 - \frac{1+d_t}{1+l_t}$ where the latter ratio of *gross growth rates* cannot be converted to elasticity $\frac{l_t}{d_t}$, providing an additional argument in favor of using the lending-funding growth gap as a measure of sensitivity. By (A.3) a positive growth gap $l_t - d_t$ implies a growing relative customer funding gap, $\Delta_t \left(\frac{L-D}{L}\right) > 0$, while a negative $l_t - d_t$ reduces the funding gap. Persistence in the positive sign of $l_t - d_t$ thus leads to a build-up of the customer funding gap in the long run.

The Bank of England (BoE, 2010) emphasizes the build-up of the relative funding gap in the major UK banks just prior to the global financial crisis of 2008-10. In Figure A.2, the period 2003-2007 prior to the financial crisis, is marked with a persistently positive lending-funding growth gap, $l - d$, especially for banks with high market power.

Similarly, in Figure A.2, a persistently positive $(l-d)$-gap is observed in the nineties, after the early nineties recession and preceding the early 2000s recession. The growing or large customer funding gap is of concern as it requires resorting to market sources of liquidity which may be scarce especially if long-term funding is required, thus raising the risk of systemic bank failures (Allen et al., 2012). In Albertazzi and Bottero (2014) banks with higher funding gap restricted their lending in the aftermath of the Lehman Brothers bankruptcy by more than those with a lower gap. The link between the lending-funding growth gap and the customer funding gap is therefore of policy relevance as (1) it may indicate potential build-up of liquidity risks, and (2) knowing the determinants of $l_t - d_t$ helps predict the change in the funding gap and through it, the accumulation of risk. Note that by Equation (A.3), banks that are likely to have a larger $l_t - d_t$, are also likely to experience a higher funding gap than their counterparts with the same leverage, as given by $\frac{D_t}{L_t}$, but lower $l_t - d_t$. Here $\frac{D_t}{L_t}$ measures a bank's reliance on deposits as the source of funds. Large banks can therefore end up with large funding gaps, as in Albertazzi et al. (2014), if they have a larger $l_t - d_t$ (which may occur if they are reluctant to reduce lending in response to a reduction in deposit intake), especially if they initially have a large portion of deposits in their funding portfolio.

An important provision of the Basel III regulatory framework is the Net Stable Funding Ratio (NSFR), i.e. the ratio of available stable funding, ASF, to required stable funding, RSF. The standard minimum requirement is $\frac{ASF}{RSF} \geq 100\%$. ASF is the weighted sum of capital and other liabilities, whereby capital and long-term (over 1 year maturity) liabilities receive a weight of 1, other deposits are weighted with .90-.95, and most remaining liabilities receive weights of .5 and below. Similarly, RSF is the weighted sum of the bank's assets, whereby long-term (over 1 year maturity) assets and non-performing loans receive a weight of 1, relatively risky performing loans and

Figure A.2: The dynamics of the $(l-d)$-gap.



Source: Authors' calculations, see details in Section 3.2

commodities receive a weight of .85, mortgages and less risky loans receive a weight of .65, and so on, with decreasing weights for decreasing liquidity risk of asset classes (see BIS, 2014, for details). Assuming loans, L, deposits, D, and capital, K, dominate a bank's balance sheet, we can write $ASF = K + \omega_D \cdot D$ and $RSF = \omega_L \cdot L$, where ω_D and ω_L are adjustment coefficients arising from the weighting of some of the loans and deposits with a weight less than 1. The minimum NSFR requirement is then

$$\frac{ASF}{RSF} = \frac{K + \omega_D \cdot D}{\omega_L \cdot L} \geq 100\%, \tag{A.5}$$

which can be written as $K \geq \omega_L \cdot L - \omega_D \cdot D$, or, by dividing both sides by $\omega_D \cdot L$ and re-arranging, as $\frac{K}{\omega_D \cdot L} \geq \frac{\omega_L}{\omega_D} - \frac{D}{L}$. The latter is equivalent to

$$\frac{K}{\omega_D \cdot L} + \left(1 - \frac{\omega_L}{\omega_D}\right) \geq \frac{L-D}{L}. \tag{A.6}$$

The right-hand side in inequality (A.6) is the relative customer-funding gap, already shown above to be related to the lending-funding growth gap, the focus of our paper. The left-hand side consists of an adjusted leverage ratio and a bank-specific constant term in the brackets. The term in the brackets reflects the composition of assets and liabilities, and is close to zero if maturity structures of assets and liabilities are close to each other, i.e. if $\omega_L \approx \omega_D$. Now a positive lending-funding growth gap implies a growing right-hand side. If loans are growing, this implies meeting the NSFR requirement is harder, equivalent to a drop in the NSFR ratio. If lending is in decline, a positive $(l - d)$-gap is less of an issue. Note however, that NSFR requirements have been introduced to prevent excessive *increase in lending*, hence our analysis of the $(l - d)$-gap is of relevance.

B Estimation of marginal cost

We estimate marginal cost using a semi-parametric estimation methods. We use the following log-linear cost function:

$$lnC_{it} = a_1 + a_2\left(z_{it}\right) lnQ_{it} + a_3 lnw_{it}^l + a_4 lnw_{it}^k + a_5 lnw_{it}^d + e_{it} \tag{B.1}$$

In equation B.1, C is the total cost of the bank i at time t, measured by the deflated total interest expenses and total noninterest expenses; Q is the total output of each bank, measured by the deflated total earning assets; w_l is the price of labor, measured by the ratio of personnel expenses to total assets; w_k is the price of physical capital, measured by the ratio of overheads minus personnel expenses to fixed assets; and w_d is the price of intermediation funds, measured by the ratio of total interest expenses to total customer deposits. In alternative specifications, we also include the price of financial capital, as measured by the ratio of equity capital to total assets, as well different levels of fixed effects, the results being unaffected. All variables are defined in Table 1.

Equation B.1 has parametric parts (those related to the input prices) and a non-parametric part (that related to bank output). The variable z, which is the so-called smoothing parameter, is crucial for the identification of the model and must be a variable that is highly correlated with a_2 and considerably varies by bank-year. Delis et al. (2016) propose using $z = lnw_{it}^l + lnw_{it}^k$, which is intuitive given the high potential correlation of input prices with the output elasticity of costs. We use the same approach and we also verify that using each input price separately yields similar results. Further, we impose the linear homogeneity restriction in input prices by normalizing total cost and the input prices by the price of deposits before taking logs. From equation B.1, we can obtain the marginal cost at the bank-year level as $\frac{\partial C_{it}}{\partial Q} = a_2(\frac{C_{it}}{Q_{it}})$ to calculate the Lerner index.

The actual estimation methodology of the semi-parametric model follows the paradigm of Fan and Zhang (1999). Specifically, and by dropping the t subscript for simplicity, we can write equation B.1 as follows:

$$Y_i = (Y_i|W_i) + e_i = X_i\beta_1 + V_i\beta_2(Z_i) + e_i \tag{B.2}$$

In this equation, β_2 is a function of one or more variables with dimension k added to the vector Z. The linear part in equation B.2 is in line with the idea of the semiparametric model as opposed to a nonparametric model (e.g., Zhang et al. (2002)). The coefficients of the linear part are estimated in the first step as averages of the polynomial fitting by using an initial bandwidth chosen by cross-validation (Hoover et al. (1998)). We then average these estimates β_{1i} and β_{2i} to receive β_1 and β_2 in equation B.2.

In the second step we use the average estimates and B.2 to redefine the dependent variable as follows:

$$Y_i^* \equiv \; Y_i - X_i\hat{\beta}_i = V_i\beta_2\left(z\right) + e_i^* \tag{B.3}$$

where the asterisks denote the redefined dependent variable and error term. $\beta_2(z)$ is a vector of smooth but unknown functions of z_i, estimated using a local least squares of the form

$$\hat{\beta}_2(z) = \left[(n\lambda^k)^{-1}\sum_{j=1}^{n} V_j^2 K\left(\frac{z_j - z}{\lambda}\right)\right]^{-1}\left[(n\lambda^k)^{-1}\sum_{j=1}^{n} V_j Y_j^* K\left(\frac{z_j - z}{\lambda}\right)\right] = [B_n(z)] - 1C_n(z) \tag{B.4}$$

where $B_n(z) = (n\lambda^k)^{-1}\sum_{j=1}^{n} V_j^2 K\left(\frac{z_j-z}{\lambda}\right)$, $C_n\left(z\right) = n\lambda^k)^{-1}\sum_{j=1}^{n} V_j Y_j^* K\left(\frac{z_j-z}{\lambda}\right)$. Equation B.4 represents a local constant estimator, where $k(z, \lambda)$ is a kernel function, λ is the smoothing parameter (chosen by generalized cross validation) for sample size n, and k is the dimension of z_i.

If we assume that z is a scalar and K is a uniform kernel, then B.4 can be written as follows:

$$\hat{\beta}_2\left(z\right) = \left[\sum_{|z_j - z|\leq\lambda} V_j^2\right]^{-1}\left[\sum_{|z_j - z|\leq\lambda} V_j Y_j^*\right] \tag{B.5}$$

In B.5, $\hat{\beta}_2(z)$ is a least squares estimator obtained by regressing Y_j^*on V_j, using the observations of (Y_j^*,V_j) for which the corresponding z_j is close to z, that is, $|z_j - z| \leq \lambda$. Therefore, to estimate $\hat{\beta}_2(z)$, we only use observations within this sliding window. Note that no assumptions are made about this estimator globally, but locally within the sliding window we assume that $\hat{\beta}_2(z)$ can be well-approximated. Also, because $\hat{\beta}_2(z)$ is a smooth function of z, $|\beta_2(z_j) - \beta_2(z)|$ is small when $|z_j - z|$ is small. The condition that $n\lambda$ is large ensures that we have sufficient observations within the interval $|z_j - z| < \lambda$ when $\hat{\beta}_2(z_j)$ is close to $\hat{\beta}_2(z)$. Therefore, under the conditions $\lambda \to 0$ and $n\lambda^k \to \infty$ (for $k1$), the local least squares regression of Y_j^* on V_j provides a consistent estimate of $\beta_2(z)$ (for a proof, see Li et al. (2002)). Therefore, the estimation method is usually referred to as a local regression. The main merit of this approach is that it is quite more flexible than the usual parametric functional forms (e.g., the translog) and this can lead to substantial improvement in the precision of the estimates.

C Tables

Table C1 of this appendix presents the number of banks used, while Table C2 presents pairwise correlations of the main variables. Finally, Table C3 is similar to Table 10 in the main text with only one difference: we now interact the crisis dummy with the NPL variable, thus explicitly studying the difference in the impact of quality of loans on our main variable of interest during crises and crisis-free times. The interaction term is insignificant in the baseline specification, yet becomes significant once we control for fixed effects at country*year and country*year*specialisation levels, with a stronger impact of the interaction term is stronger when deposits decline.

Table C1: Number of banks in the sample

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
All countries														
	91	100	114	152	399	973	1,262	1,411	1,488	4,072	3,929	6,197	6,100	6,030
Income groups														
LI					3	6	7	14	20	48	59	68	75	79
LMI	14	15	15	21	37	54	61	63	64	225	219	252	260	256
OECD	71	79	92	118	327	860	1,126	1,240	1,285	3,356	3,211	5,373	5,203	5,115
OHI	3	3	3	3	5	8	11	19	26	85	86	84	91	90
UMI	3	3	4	10	27	45	57	75	93	358	354	420	471	490
Regional groups														
EAP	4	5	4	6	13	18	25	26	27	117	90	91	86	91
ECA					1	1	2	5	11	84	76	136	156	174
LAC	4	4	5	10	17	40	50	64	69	264	288	311	352	337
MENA				1	12	20	19	21	23	48	42	47	48	41
SA	10	10	11	14	23	24	27	28	32	74	79	83	84	88
SSA					2	6	6	12	19	81	93	105	118	122
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
All countries														
	5,899	5,786	5,916	7,175	7,303	7,618	7,502	7,544	7,215	4,873	4,929	4,925	4,861	4,414
Income groups														
LI	89	100	107	121	123	139	168	186	179	139	151	157	164	139
LMI	270	287	329	373	383	403	408	444	424	279	300	309	291	277
OECD	4,942	4,758	4,801	5,709	5,631	5,707	5,479	5,542	5,354	3,677	3,668	3,652	3,648	3,304
OHI	92	87	92	100	101	101	93	96	90	73	77	75	74	66
UMI	506	554	587	872	1,065	1,268	1,354	1,276	1,168	705	733	732	684	628
Regional groups														
EAP	98	108	131	156	170	185	207	223	222	178	196	202	193	180
ECA	229	277	312	614	779	941	975	865	756	354	359	363	342	314
LAC	297	303	316	311	336	360	377	410	410	315	322	319	290	266
MENA	44	48	50	45	55	65	75	91	86	59	63	59	54	51
SA	94	103	109	115	110	112	117	133	135	90	113	114	116	113
SSA	133	138	143	168	168	193	220	230	210	169	172	180	183	152

LI refers to the low-income economies, LMI refers to the lower-middle-income economies, OECD refers to the OECD member countries, HI refers to high-income economies other than OECD countries, and UMI refers to upper-middle-income economies. EAP refers to East Asian and Pacific countries, ECA to the European and Central Asian countries, LAC refers to Latin American and Caribbean countries, MENA refers to Middle Eastern and North African countries, SA refers to Southern Asian countries and SSA refers to Sub-Saharan African countries.

Table C2: Correlation table

	Lending-funding growth gap	Non-performing loans	Lerner index	Lerner index squared	CR5	ROA	Equity	Bank size	OBSI size	GDP growth
Lending-funding growth gap	1									
Non-performing loans	-0.0645*	1								
Lerner index	0.00120*	-0.0570*	1							
Lerner index squared	-0.0001*	-0.0114*	0.9194*	1						
CR5	0.0060*	0.0534*	0.1704*	0.2192*	1					
ROA	0.0516*	-0.1955*	0.4474*	0.4392*	0.1552*	1				
Equity	-0.0226*	0.0473*	0.2325*	0.2197*	0.1376*	0.0515*	1			
Bank size	-0.0223*	0.0464*	0.1309*	0.1028*	0.0391*	-0.0615*	0.9409*	1		
OBSI size	-0.0076*	0.0301*	0.1921*	0.1853*	0.2158*	0.0415*	0.7477*	0.7346*	1	
GDP per growth	0.0914*	-0.1449*	-0.0928*	-0.0870*	-0.1410*	0.0632*	-0.0981*	-0.0782*	-0.4593*	1

The table reports the pair-wise correlations. The variables are defined in Table 1. The * marks denote statistically significance at the 5% level.

Table C3: Financial crisis and quality of loans

	Full sample			Deposits DOWN			Deposits UP		
	I	II	III	IV	V	VI	VII	VIII	IX
Non-performing loans (%)	-0.229***	-0.177***	-0.148***	-0.226***	-0.164**	-0.197***	-0.197***	-0.201***	-0.152***
	[-7.113]	[-5.331]	[-3.900]	[-3.198]	[-2.397]	[-2.840]	[-5.315]	[-6.824]	[-3.763]
Non-performing loans(%)*Crisis	0.004	-0.147**	-0.222**	0.008	-0.236*	-0.454***	-0.252	-0.188*	-0.335*
	[0.055]	[-2.299]	[-2.276]	[0.051]	[-1.865]	[-2.786]	[-1.356]	[-1.889]	[-1.824]
Lerner index	-14.510***	-10.049***	-13.109***	-24.662***	-19.908***	-19.525***	-10.752**	-11.630***	-9.973*
	[-3.976]	[-2.691]	[-3.533]	[-3.921]	[-3.051]	[-3.202]	[-2.130]	[-3.220]	[-1.937]
Lerner index squared	16.626**	19.623***	16.572**	35.005***	37.002***	27.653**	15.879*	15.536**	22.940**
	[2.410]	[2.755]	[2.316]	[2.871]	[2.886]	[2.265]	[1.755]	[2.412]	[2.443]
Observations	44,710	44,710	44,351	16,235	16,235	15,734	26,496	26,496	26,496
R-squared	0.181	0.174	0.256	0.299	0.294	0.355	0.244	0.247	0.252
Turning point (Lerner index)	0.436	0.256	0.395	0.352	0.269	0.353	0.338	0.374	0.217
Join significance (Lerner index)	0.000	0.019	0.000	0.000	0.008	0.003	0.100	0.004	0.047
Chow test (P-value) $H_0 : \widehat{\beta}^{Deposit\ Down} = \widehat{\beta}^{Deposit\ UP}$				0.000	0.000	0.000	0.000	0.000	0.000
Control Variables (Bank-Country)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	N	N	Y	N	N	Y	N	N
Bank FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country*Year FE	N	Y	N	N	Y	N	N	Y	N
Country*Year*Specialization FE	N	N	Y	N	N	Y	N	N	Y
Clustered standard errors	Country	Country	Country	Country	Country	Country	Country	Country	Country

The table reports coefficients and t-statistics (in brackets). We estimate the regression $[GL_{i,j,t+1} - GD_{i,j,t+1}] = \alpha_f + MP_{i,j,t} + MP^2_{i,j,t} + NPL_{i,j,t-1} + X_{i,j,t} + Z_{j,t} + \varepsilon_{i,j,t}$, where i is an index specific to the bank; j is an index specific to country; and t is an index for years. $MP_{i,j,t}$, measures the Lerner index, $MP^2_{i,j,t}$, measures the Lerner index squared and $NPL_{i,j,t-1}$, measures non-performing loans. All variables are defined in Table 1. In columns IV-VI and VII-IX we restrict our analysis only to periods with declining deposits (< 0) and rising deposits (> 0), respectively. All regressions are estimated with High Dimensional Fixed Effects (HDFE), include the control variables that are reported in Table 4 and fixed effects as noted in the lower part of the table to control for different levels of unobserved heterogeneity. Standard errors are robust and clustered at the country level. The *,**,*** marks denote the statistical significance at the 10, 5, and % level, respectively.

Table C4: Average estimates of market power

		Percentile distribution				
		10	25	50	75	90
Year	Lerner index	Lerner index	Lerner index	Lerner index	Lerner index	Lerner index
1988	0.160	0.043	0.131	0.184	0.184	0.264
1989	0.135	0.039	0.104	0.161	0.161	0.219
1990	0.114	0.048	0.066	0.137	0.138	0.182
1991	0.129	0.059	0.104	0.129	0.150	0.150
1992	0.146	0.087	0.136	0.150	0.150	0.164
1993	0.187	0.143	0.173	0.173	0.173	0.263
1994	0.206	0.138	0.207	0.207	0.207	0.243
1995	0.198	0.160	0.195	0.195	0.195	0.227
1996	0.209	0.176	0.203	0.203	0.203	0.241
1997	0.200	0.126	0.184	0.197	0.228	0.255
1998	0.178	0.135	0.162	0.162	0.199	0.234
1999	0.210	0.142	0.173	0.222	0.254	0.254
2000	0.198	0.150	0.150	0.223	0.230	0.232
2001	0.211	0.143	0.143	0.217	0.267	0.267
2002	0.244	0.166	0.166	0.214	0.323	0.323
2003	0.263	0.180	0.182	0.251	0.341	0.341
2004	0.256	0.191	0.193	0.249	0.306	0.311
2005	0.249	0.187	0.187	0.245	0.296	0.314
2006	0.248	0.205	0.206	0.256	0.266	0.304
2007	0.225	0.171	0.171	0.229	0.246	0.287
2008	0.223	0.159	0.176	0.214	0.236	0.285
2009	0.279	0.212	0.212	0.259	0.362	0.362
2010	0.294	0.210	0.255	0.277	0.364	0.364
2011	0.293	0.206	0.264	0.267	0.367	0.388
2012	0.294	0.208	0.253	0.283	0.366	0.385
2013	0.306	0.218	0.269	0.282	0.380	0.406
2014	0.312	0.237	0.273	0.279	0.368	0.398
2015	0.321	0.218	0.290	0.301	0.404	0.417
Mean	0.249	0.159	0.191	0.244	0.296	0.362

This table reports average estimates of market power by year. Averages are obtained from the bank-year level estimates of market power using the Lerner index weighted by market shares. Higher values reflect higher market power (lower competition).